

SUPPLEMENT

TO

THE MEDICAL JOURNAL OF AUSTRALIA

SYDNEY, SATURDAY, JULY 12, 1924.

Section IX.—Diseases of Children.

(Continued.)

DISCUSSION ON RICKETS.

DR. HARVEY SUTTON addressed his remarks to the preventive aspect of the subject of rickets. Of two thousand school children examined in Melbourne 20% showed clinical evidence of rickets. The manifestations on the whole had been very slight; no seasonal incidence could be determined and only very few of the children had been breast-fed. Altogether "surgical rickets" was very rare. Cranio-tabes was extremely rare. He did not agree that rickets was in large measure responsible for dental caries.

The question of rickets was not essentially an economic problem, nor was it a light problem. He felt that the dietetic factor was supreme. Of prime importance was fresh food, including milk. Even if rachitic manifestations set in early, recovery was possible with care and attention to the factors of diet and light.

DR. DOUGLAS GALBRAITH said that it was gratifying to note that from the maze of literature on the subject of rickets the aetiological factors were at last emerging. The work of Leonard Findlay in Glasgow disclosed the great importance of the light factor and while he was associated with Dr. Findlay no diagnosis of rickets was made unless it was confirmed by X-ray examination.

DR. F. TRUBY KING congratulated Dr. Dalyell on her interesting paper. It was too soon to allocate exactly the parts played by the different factors bearing on the occurrence of rickets. However, one thing seemed to be established by what Dr. Dalyell has presented, taken in conjunction with the work and conclusions of Alfred Hess and others in America during the last few years, that restriction of the ultra-violet rays played an extremely important rôle in the causation of rickets and that the efficacy of certain fats and oils, especially cod liver oil, as an important curative factor had been confirmed. On the other hand, he could not pass by the pointed way in which Dr. Harper had referred to one case of rickets which came under her own personal care when taking some "New Zealand Emulsion" in its food. Nothing was said as to how much nor for how long nor as to what else the child was getting, nor what was its environment nor how it had been fed previously. Seeing also that nearly half the black babies fed at their mother's breasts in the southern States of North America were said to suffer more

or less from rickets, he failed to see the significance of Dr. Harper's single case or the justification of her jumping to the conclusion that a particular source of a fraction of the fat in the diet was at fault. Probably over three-fourths of the fat this child had been taking, was in the form of butter-fat, including the fat in the milk, and a third of the balance cod liver oil. Dr. Harper made the mistake of assuming that the fat element in "New Zealand Emulsion" contained only 10% of cod liver oil, whereas it is expressly stated that 75% consists of butter fat and cod liver oil, these being present in practically equal proportions. There was no reason to suppose that a larger proportion of cod liver oil would be preferable, unless rickets had become definitely established. His experience had been that the fat in a young infant's food could not be advanced to the normal without "upsetting the stomach" or causing vomiting if ordinary cod liver oil emulsion was used for complementing. No such trouble was encountered when a suitable mixture of fats and oils such as existed in "New Zealand Emulsion" was given.

DR. R. B. WADE drew attention to the frequency of occurrence of rickets in the children of dark skinned immigrants.

DR. DALYELL in reply said that it was well recognized that dark pigmentation of the skin exercised a great influence on the action of sunlight. She was of opinion that dental caries in Australian children was almost certainly, in part at least, attributable to rickets.

ESSENTIALS FOR INSURING GOOD NUTRITION IN INFANCY AS BEARING ON THE PREVENTION OF INFANTILE DIARRHOEA.

By F. TRUBY KING, C.M.G., M.B., B.Sc. (Public Health)
(Edinburgh),

Director of Child Welfare for New Zealand.

SEEING that during the discussion on dysenteric conditions in children the whole question of infantile diarrhoeas has been touched on, as regards nature, treatment and results, my task in dealing with prevention seems comparatively simple. What must have struck all of us yesterday was the extreme and irreconcilable differences of opinion expressed as to the value of various lines of diagnosis and treatment. One is on surer ground when dealing with prevention, which may be almost summed up in our experience in thorough and consistent education

of the whole community as to the care and feeding of children.

Much light is thrown on the subject by dairy calves, the only other young mammals habitually fed artificially. Thirty years ago after taking charge of a large dairy farm, I was struck with the deficient growth and high mortality from "scouring" due to artificial feeding, not only on our own farm, but throughout the whole country. At six months these calves averaged over fifty pounds, less than those which were suckled, and fully 20% were lost in the rearing. The disease which carried them off was scouring (infantile diarrhoea) preceded generally by obviously impaired nutrition, but in one instance it came on quite suddenly as a very virulent form of acute infective inflammation of the lower bowel, similar to ileocolitis of infants. This was due to drinking water accidentally contaminated with drainage. No further cases occurred after isolation and the cutting off of the fouled water.

Nearly seventeen years ago the New Zealand Society for the Promotion of the Health of Women and Children was founded, mainly as the outcome of extensive practical experience of the effects of science and system applied to the rearing of stock, and from my realizing the effects of almost universal suckling, seen when spending a winter in Japan in the middle of the Russo-Japanese War. Some thirty millions of breast-fed people, reared in the open country, were impressive enough; and the high efficiency and prowess of the Japanese army was the natural result. Contrasted with this, Major-General Sir Frederick Maurice had published (some twenty-two years ago) his memorable article in *The Contemporary Review* on National Deterioration, as observed by himself in connexion with recruits for the British Army; the outcome of consequent investigations by the British authorities had shown that motherhood was most at fault, accounting largely for the tragedy of the teeth and all round inefficiency. General Maurice said that to fold our hands in the face of such facts, and decide that nothing could be done, would make us "guilty of the worst of all civic crimes, to despair of the State."

We decided to do what we could. Our Society, namely called later the "Plunket Society" was formed. This has since spread over the whole Dominion and has now some eighty Branches run by about 1,500 members of Committees with advisory boards of men. The society has become intimately associated with the Government and with the Health and Education Departments. Its main aims and objects, as drawn up in the beginning and continued ever since, are as follows:

(i.) To uphold the sacredness of the body and the duty of health, to inculcate a lofty view of the responsibilities of maternity and the duty of every mother to fit herself for the perfect fulfilment of the natural calls of motherhood; (ii.) to acquire accurate information and knowledge on matters affecting the health of women and children, and to disseminate such knowledge; (iii.) to train specially and to employ qualified nurses [later called Plunket Nurses], to give sound, reliable instruction, advice and assistance *gratis* to any member of the community desiring such service on matters affecting the health and well-being of women, especially during preg-

nancy and while nursing infants, and on matters affecting the health and well-being of their children.

There is, as Dr. Howard Kelly says, speaking of education in motherhood and mothercraft, "as much need for going to school on the part of the ignorant-and-well-to-do as there is on the part of the so-called poor-and-ignorant." All classes in New Zealand avail themselves of the teaching provided by the Plunket Society.

The society's aim is to give every woman at least the irreducible minimum of knowledge needed to safeguard the health of herself and her offspring, to teach her what Florence Nightingale called the simple "laws of life and death for men and the laws of health for houses," especially as affecting mother and child. As this great thinker said "the necessary knowledge does not come by intuition to the loving heart and fearful is the wrong that has resulted from such wild and foolish notions."

Granted that a state of perfect health and nutrition utterly outweighs all other preventives of disease, especially in early life, the one person above all others who needs to know and put in practice the essentials for health, is obviously the mother. She is on duty unremittingly day and night. Of course our health mission has had medical and nursing skill behind it, but the main executive has been and must be the mothers themselves.

How effective the New Zealand policy has been is shown by reference to the one great scourge of infancy, namely gastro-enteritis and diarrhoea. The infantile death rate from all causes for the whole Dominion has been reduced almost to a half in the last sixteen years; but it is infinitely more significant that in Dunedin, where the Plunket Society was founded, where its first Mothercraft training centre was established and where the work has been carried out most thoroughly and intensively, not a single child has died of gastro-enteritis in the first two years of life during the last two years. Yet in 1907, the year when the Plunket Society was formed, the death rate in Dunedin from infantile diarrhoea was twenty-five per thousand births.

I may here give a few extracts from my last annual report as Director of Child Welfare for New Zealand which is in your hands. Comparing New Zealand with Australia, the report points out:

(i.) Originally the total infantile-mortality rates from all causes differed but little in the two countries.

(ii.) That coolness and equability of the New Zealand climate is not the cause of the present discrepancy is shown by the simple fact that the average total infantile-mortality rate for Queensland is considerably lower than the rate for Tasmania which is climatically similar to New Zealand, and that in the Dominion the subtropical city of Auckland has a low rate.

(iii.) That the relative sizes of cities is not the determining cause, is shown by the fact that while our cities have been almost doubling their populations, they have been nearly halving their total infantile-mortality rates; and in 1920 the City of Auckland, with about 200,000 inhabitants, lost a smaller proportion of babies than Wellington, Christchurch or Dunedin which average only half the population of Auckland.

Further, compare the infantile diarrhoea mortality of Dunedin, with about 100,000 inhabitants, and that of Hobart with about 50,000:

For 1913-1917 the Dunedin rate had fallen to	4 per 1000.
While Hobart stood at over	19 per 1000.
For 1918-1922 Dunedin lost	0.8 per 1000.
For 1918-1922 Hobart lost	15 per 1000.

For the last two years Dunedin has had no deaths from infantile diarrhoea (see Chart A.).

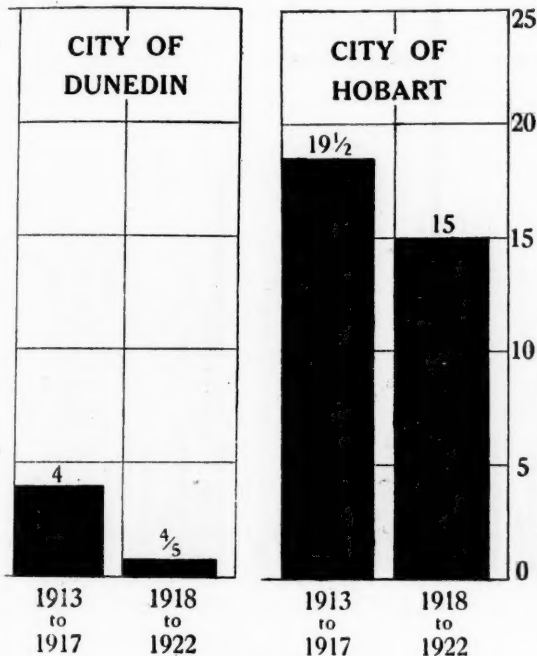


CHART A.
Quinquennial Mortality Rates from Gastro-Enteritis and Diarrhoea Per Thousand Births.

(iv.) That New Zealand enjoyed no natural immunity to infantile diarrhoea and enteritis is proved by the fact that from fifteen to twenty years ago this form of disease killed annually from ten to twenty babies per thousand births. For the last five years, as shown on the accompanying graphs, the average rate for the Dominion has been only three deaths per thousand, as compared with thirteen deaths per thousand for the Commonwealth. More significant still is the fact that whereas formerly the deaths in New Zealand from infantile diarrhoea and enteritis occurred mainly in the cities and are still regarded in Australia and elsewhere as almost inevitable concomitants of crowded city life, the position as between town and country has been reversed in New Zealand during the last sixteen years. Twice in the last five years not a single baby has died in Dunedin of diarrhoea and enteritis and the average rate for the whole five years has been under one death per thousand births, compared with twenty-five per thousand in 1907 (see Charts B. and C.).

(v.) If the combined factors of subtropical climate and aggregation in cities were the essential factor of infantile diarrhoea, Auckland should have almost as high a death-rate from this cause as Sydney, and yet for the last five

years the average rate for Sydney has been twenty per thousand births and for Auckland only 4.4. The persistence in Australia and Tasmania of gastro-enteritis as the main cause of death among infants who survive their first month, and the extreme reduction of the disease in New Zealand cities of late years—as most strikingly illustrated in Dunedin—is to be attributed to one essential cause—viz., the systematic education and training in mothercraft which has been carried on throughout the Dominion for the last sixteen years and longest and most intensively in Dunedin.

With regard to the Plunket Nurses we find them as necessary for the proper carrying out of preventive and therapeutic work among children as are specially trained nurses for the efficient practice of modern medicine, surgery or midwifery. These nurses have proved loyal helpers, not hinderances to the doctors; but unfortunately the subject of pædiatrics has not been given its proper place or due share of attention in the medical schools and lack of knowledge and consistency on the part of graduates militates against the progress of child welfare. How this sometimes affects the rational consistent treatment of diarrhoea even now in New Zealand will be realized from the following paragraph at the beginning of a letter I have just received from Miss Patrick, the Director of Plunket Nursing for our Dominion, in which she says:

Regarding the question as to the treatment of diarrhoea (dietetic) I find some difficulty in summing up from actual experience. The outstanding difficulty is that when a Plunket Nurse visits the home or when a baby is brought to our rooms obviously ill from diarrhoea, the nurse must always advise the mother to consult a doctor immediately, and after that the nurse can only follow on the lines advocated by the particular doctor. Often much confusion of thought ensues, and the nurse becomes very worried, but of course nothing else can be done under the circumstances.

Reading between the lines, anyone can see the difficulty, a difficulty which can only be overcome by reasonably consistent lines of thought, teaching and practice.

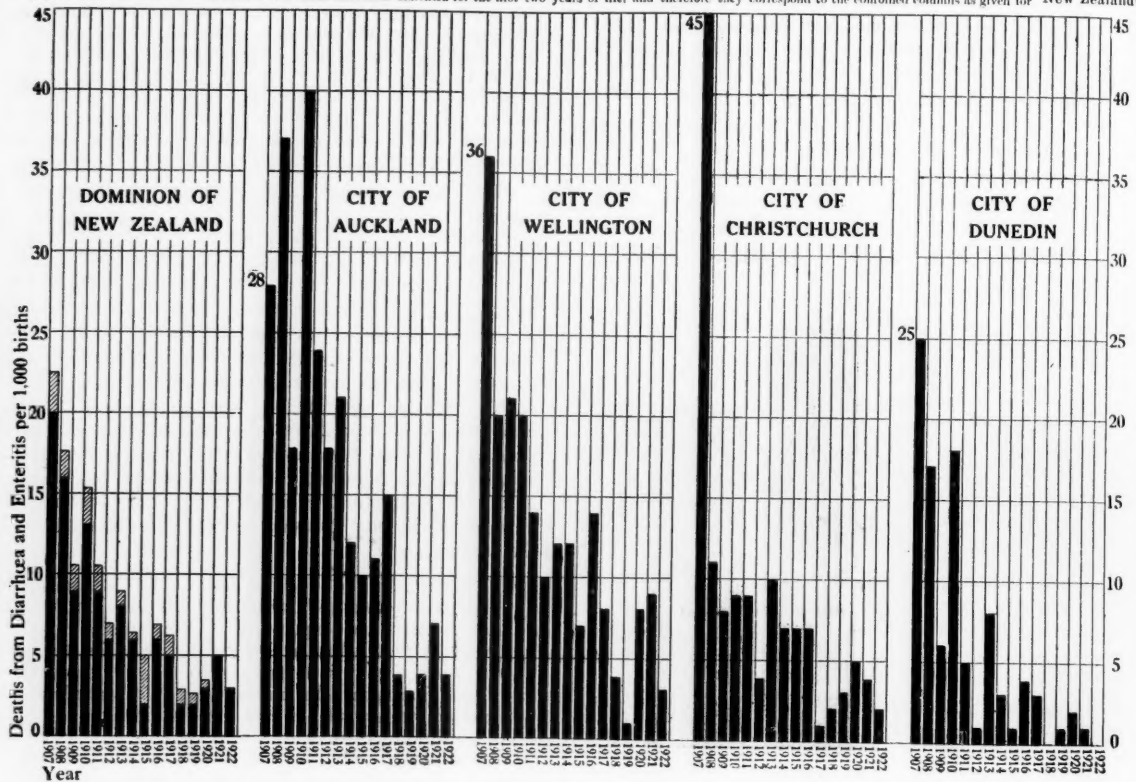
The above letter was written in answer to a hurried note I wrote to Miss Patrick when I was leaving New Zealand, asking for a short summary of the work and experience of her nurses, in special connexion with the prevention and treatment of infantile diarrhoeas.

However, that we have gone a long way towards insuring simple, consistent authoritative advice and instruction for mothers and nurses throughout our country, is shown by the fact that in the capital (Wellington) the care of children in the main general hospital is carried out on the lines evolved and practiced by the Plunket Society and the aftercare of all young children on leaving the institution is entrusted to the Plunket Nurses. Dr. Wilson, the Medical Superintendent, said recently:

The Plunket Society has become practically part of the work of our hospitals. Our hospitals must work hand in hand with the society. What seems to me one of the most important aspects of the work of the Plunket Society is the fact that it has established unity throughout the Dominion in regard to the feeding and care of children.

ANNUAL MORTALITY-RATES FROM GASTRO-ENTERITIS AND DIARRHOEA PER THOUSAND BIRTHS, 1907-22.

- (1.) For the Dominion of New Zealand.—(a) The lower, solid, black columns show the deaths from diarrhoea in the first year of life; (b) the hatched part above shows the deaths in the second year of life; (c) the total height of each combined column shows the rate for the first two years of life.
(2.) For the Cities.—The columns all show the death-rates from diarrhoea for the first two years of life, and therefore they correspond to the combined columns as given for New Zealand*.



* New Zealand.

CHART B.

INFANTILE DIARRHOEA ANNUAL DEATHS in first 2 Years PER 1,000 BIRTHS.

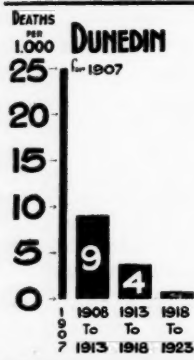


CHART D.

The following is given as a sample of the kind of Chart found Effective in Bringing the Community to Realize the Value of Care and System in the Rearing of Children and the Prevention of Disease.

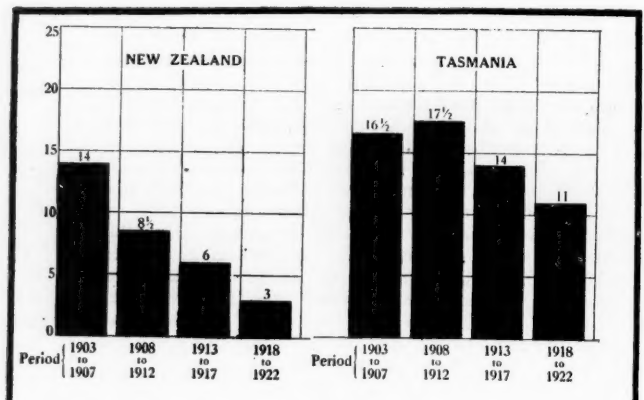


CHART E.

Quinquennial Mortality Rates from Gastro-Enteritis and Diarrhoea Per Thousand Births.

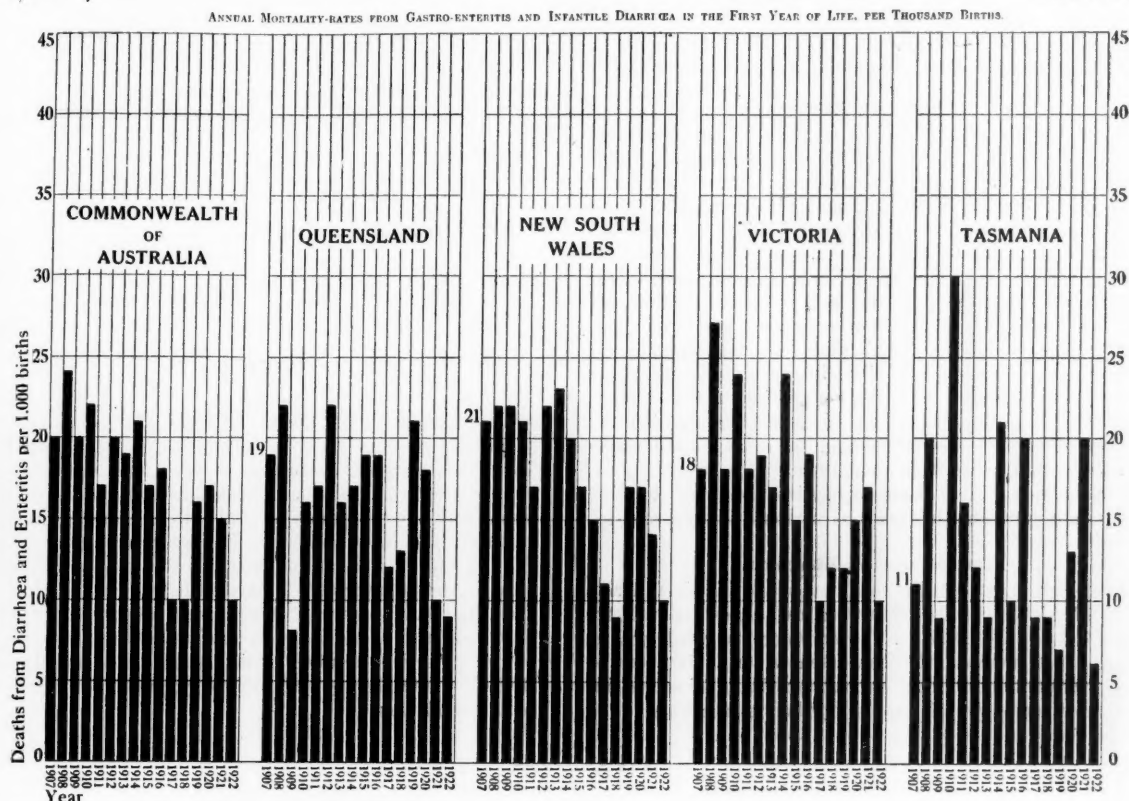


CHART C.

I feel this is a matter of supreme importance for the Wellington Hospital. Our children are fed and cared for according to the Plunket system and the Plunket Nurses are supplied with details regarding each child discharged from the hospital, so that what is done in the institution may be consistently continued and followed up outside in the home.

The General Hospital at Christchurch has just adopted a similar policy, Dunedin is moving in the same direction, and we look forward confidently to the establishment, of consistency and cooperation in regard to pædiatrics throughout the whole hospital service of the Dominion in the near future.

Finally, I may point out that this tendency to uniformity is shared by the guardians of children coming

under the special care of institutions or services conducted by various religious bodies. They employ nurses trained by the Plunket Society and do their work on the same lines as ourselves. This obtains also in the Government maternity hospitals where it has been decided that the matrons must be what is called "Plunket-trained." The authorities of the Education Department make a similar stipulation.

A remark by Professor Kenwood, regarding the most urgent requirement for infant welfare in England, is certainly confirmed by our New Zealand experience. He said: "The main thing is to disseminate uniform, authoritative advice on the essentials for health." One need not labour the bearing of this aphorism on the wiping out of the infantile diarrhœas.

THE DIAGNOSIS AND TREATMENT OF
CONGENITAL SYPHILIS.

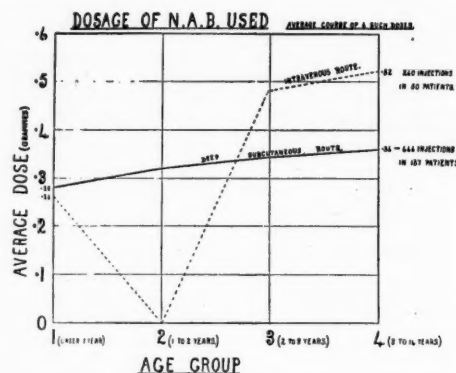
By H. BOYD GRAHAM, D.S.O., M.C., M.D.,
Medical Superintendent, Children's Hospital, Melbourne.

Introductory Remarks.

WITH the cooperation of the members of the honorary medical staff of the Children's Hospital, Melbourne, I have been permitted to control the treatment of over one hundred indubitably syphilitic children since June, 1920. Emboldened by the work of Dr. Leonard Findlay, of Glasgow, it has been my custom to use relatively large doses of "Nov-arseno-billon." The results have been so much more satisfactory when the patients have received injections in the first few years of life than they have been when the treatment has been postponed, that the opportunity presented now of wide-spread dissemination of this information is seized in the hope that practitioners will advise treatment by injections of an arsenical preparation of proved efficacy in adequate dosage as soon as the diagnosis of syphilis has been established. This procedure is not dangerous if reasonable precautions be taken to discover very occasional instances of personal idiosyncrasy to arsenic.

The Scheme of Treatment.

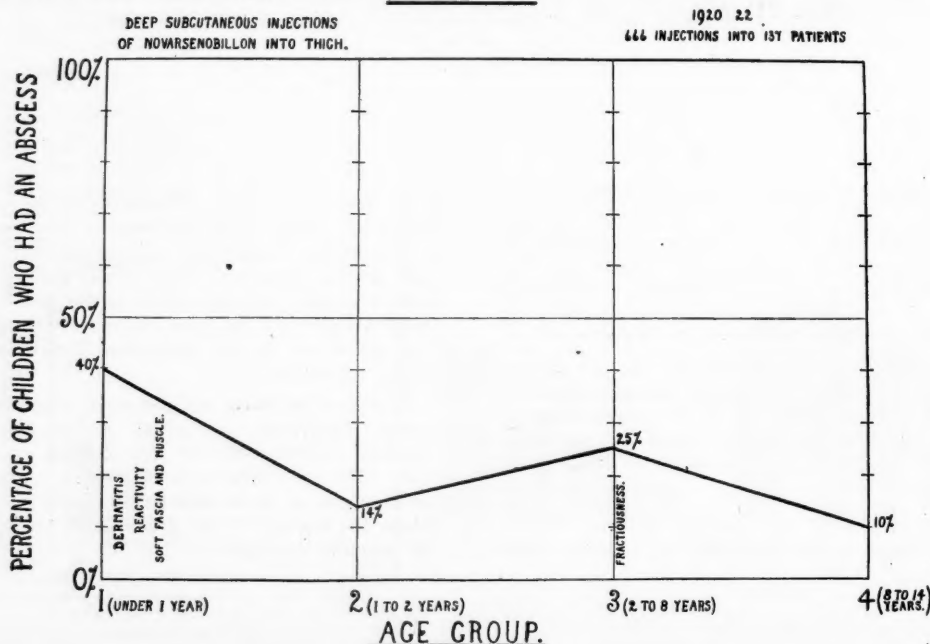
Deep subcutaneous injections under the ilio-tibial tract of the *fascia lata* of the thigh were used almost exclusively until October 31, 1921. The substance injected was a concentrated solution of "Nov-arseno-billon," sixty centigrammes of the arsenical preparation being dissolved in one cubic centimetre of freshly distilled, sterile water.



GRAPH I.

The average dose (Graph I.) was thirty-three centigrammes, varying from twenty-eight centigrammes for babies to thirty-six centigrammes for older children. A course consisted of six such injections at intervals of one week and it was usual to have to administer further courses to the older children. The occurrence of abscesses (Graph II.) is a serious objection to this method of treatment. Almost invariably I have failed to grow organisms from the fluid aspirated from these abscesses, but the abscesses take many weeks to heal and though only about 4% of injections resulted in the formation of an abscess, 40% of young babies and 25% of young children had at least one abscess.

ABSCESSSES



GRAPH II.

During the next year I tested the practicability of the percutaneous intravenous route (Graph III.).

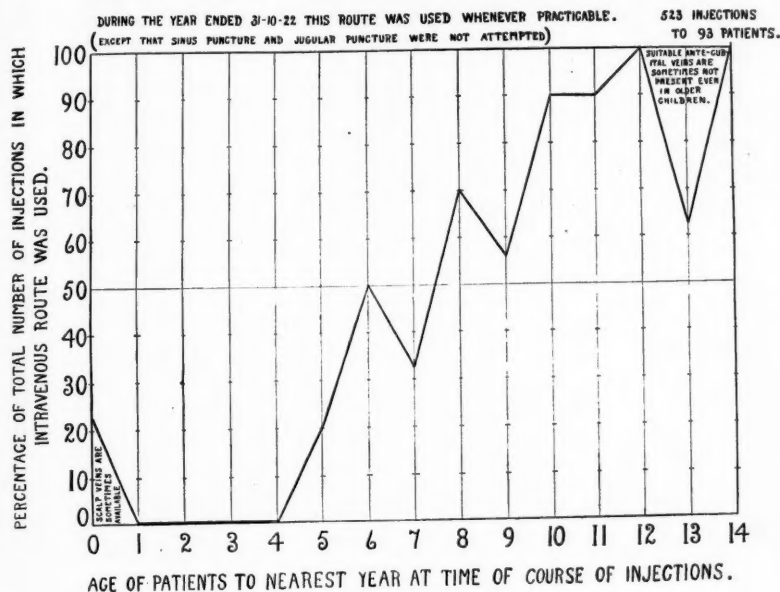
I did not use the longitudinal sinus because this procedure is so dangerous or the jugular vein because the absence of a firm background makes it difficult and, except for a few injections into prominent scalp veins, I was unable to use the intravenous route in children under four years old, but from that age upwards it became available in a large percentage of instances, though even in older children, chiefly on account of adiposity, I was sometimes unable to introduce a needle into the ante-cubital vessels through the skin.

By the use of the percutaneous intravenous route whenever it was available, I was able to give a larger average dose (Graph I. and IV.).

I have succeeded in keeping a majority of my patients under observation and, as a rule, have secured a serological examination of the blood six weeks and three months after the conclusion of a course of injections and further examinations at three-monthly intervals for the first year and at six-monthly intervals afterwards.

The examination six weeks after the course of injections may not result in a "negative" report and yet without further treatment the subsequent reports may be "negative." I regard this observation as an important one for two reasons. The application of it is economical for the alternative is to continue with further injections until the blood fails to yield the reaction as is advocated by Findlay and others. The second reason is that it would appear that there is a period of time during which the "Wassermann substance" is being eliminated without any more of it being elaborated which may be contrasted with the accumulation of "Wassermann substance" necessary to yield the reaction in instances of primary acquired syphilis and in the early weeks of some of the subjects of congenital syphilis. If this conception prove to be accurate, it will indicate that the Wassermann reaction is not the delicate test we take it to be at present, but a comparatively coarse test only capable of detecting a certain concentration of "Wassermann substance" in the serum. If this reasoning be correct, it is easy to understand why failure to react to the Wassermann test does not always mean the absence of syphilis.

PRACTICABILITY OF THE PER-CUTANEOUS INTRAVENOUS ROUTE



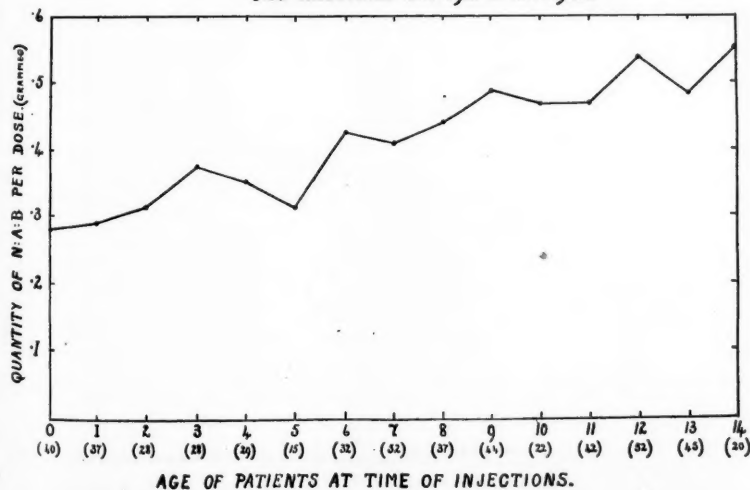
GRAPH III.

AVERAGE DOSE

OF N:A:B BY YEARS OF AGE

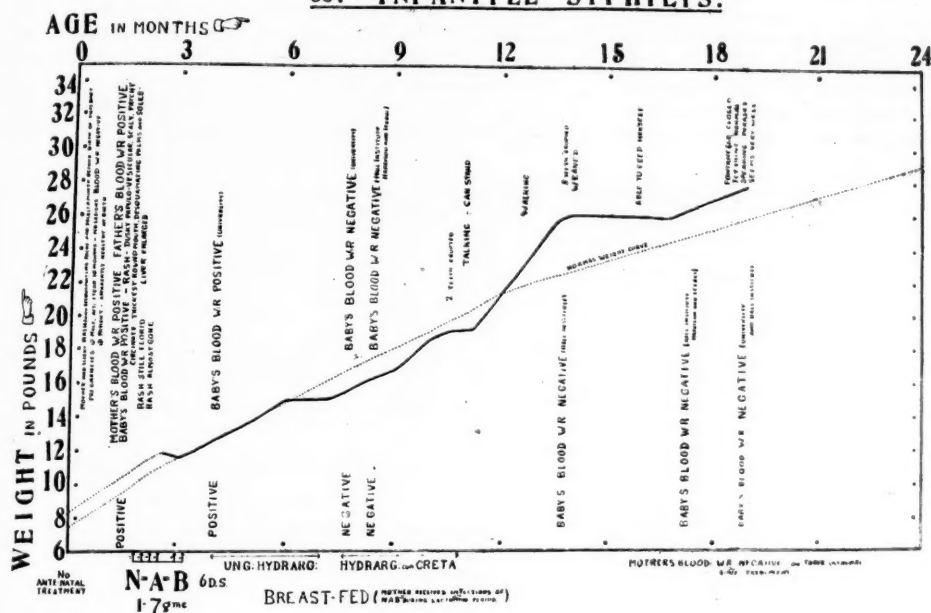
USING PERCUTANEOUS INTRAVENOUS ROUTE WHEN PRACTICABLE.

523 INJECTIONS NOV: 1921 TO OCT: 1922.



GRAPH IV.

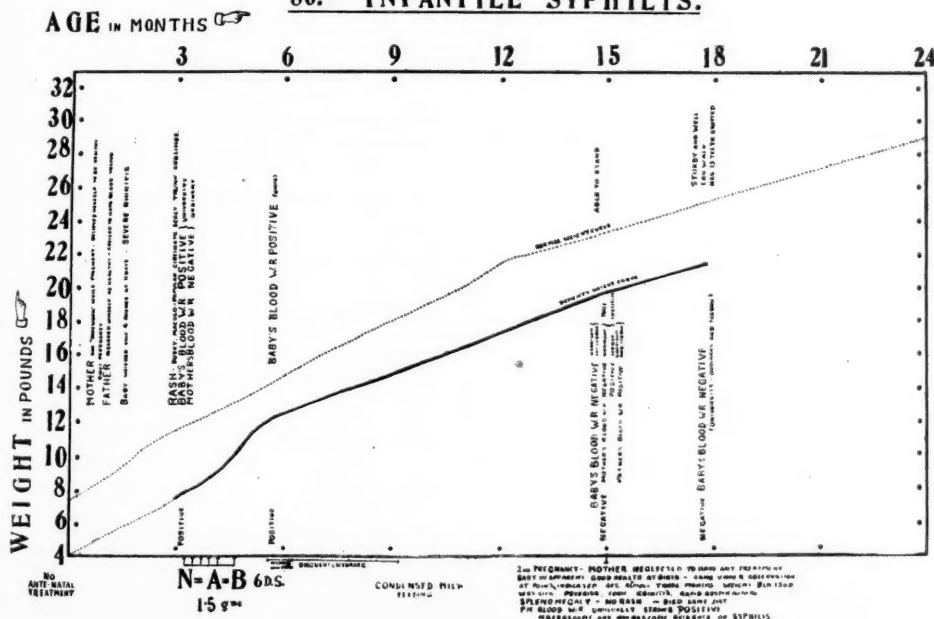
63. - INFANTILE SYPHILIS.



GRAPH VII.

Serial No. 63. A congenital syphilitic child as a result of the first pregnancy after syphilis entered the family. The serum yielded the reaction three weeks after the completion of the injections, but thereafter has failed to do so. The mother has received satisfactory treatment.

80. - INFANTILE SYPHILIS.



GRAPH VIII.

Serial No. 80. An example of severe infantile syphilis and a curious anomaly in the reaction of the mother's serum on two occasions. The failure of the serum to react on the first occasion led her to disregard the necessity for treatment with disastrous results to her next baby. The patient's serum yielded a reaction within six weeks after the completion of the injection, but failed to do so, even to the ice box technique at two independent laboratories on subsequent occasions.

Results of Treatment: Progress Report.

The most brilliant results follow efficient ante-natal treatment and undoubtedly the time of election for the commencement of the treatment of a congenital syphilitic is before the birth of the patient. If ante-natal treatment has been omitted, as was the case with all of the children that I have been called upon to treat, apparently complete success may be attained by means of injections of "Nov-arseno-billon" during the first year or two of the

all of them ceased to yield the Wassermann reaction and child's life. The earlier this treatment is instituted, the greater is the probability of the survival of the child and the smaller is the total quantity of the drug that will be required. All those babies that received at least one gramme of "Nov-arseno-billon" in the first year of life have progressed satisfactorily and though one (No. 50) ultimately died of empyema and pericarditis, the sera of eight that have been kept under observation (Nos. 2, 25,

Tables I. and II. show details of the histories and progress of all the babies who have derived substantial benefit from the treatment indicated.

Abbreviations used in Tables I., II., III. and IV. In the column to which the heading is "Age," the figures indicate the age of the patient at the time of the first injection. In the column to which the heading is "Treatment," "N.A.B." stands for "Nov-arseno-billon"; the total quantity of N.A.B. administered is indicated in grammes, e.g. "2.1 gr."; the total number of injections is placed as a figure in front of the route of injection: "D.S." stands for "Deep Subcutaneous Route," and "I.V." for "Percutaneous Intravenous Route."

In those columns dealing with the serological findings the reports from the University Bacteriological Department (Dr. R. J. Bull) are abbreviated as under: P. Positive, d. Good Partial or Partial, fn. Feeble Partial, n. Negative. The technique used is indicated: O. Ordinary, I. Icebox. Reports from the Walter and Eliza Hall Institute for Research in Pathology and Medicine are abbreviated as under: P. Positive, D. Doubtful, N. Negative, H. Harrison technique, I. Icebox technique.

TABLE I.

SERIAL NUMBER	NATURE OF EVIDENCE UPON WHICH DIAGNOSIS IS BASED	AGE IN MONTHS	TREATMENT	Within 6 weeks to	6 weeks 3 months to	3 months 6 months to	6 months 9 months to	9 months 1 year to	1 year 1 1/2 years to	1 1/2 years 2 years to	2 years to 2 1/2 years
2	At 2 months, conjunctivitis, rhinitis. At 3 months, generalised rash. At 7 months, mother and baby POSITIVE.	8	2.0 gr. N.A.B. 6 D.S.	-	-	-	n O	n O	N HI	N HI	N HI
25	Ulcerous urinary meatus from 2 weeks to 8 months. Mother and baby POSITIVE.	11	1.3 gr. N.A.B. 4 D.S.	-	-	n O	N HI	n O I	N HI		
30	At 3 months, widespread rash with peeling palms and soles, POSITIVE. (Mother died, father NEGATIVE.)	3	2.2 gr. N.A.B. 6 D.S.	-	p O	n O	n O	n O I	n O		
36	At 3 weeks, haemorrhagic rhinitis, at 4 weeks, severe rash, macules, mucous patch at anus, epimongy. At 6 weeks, mother and baby POSITIVE.	2	2.5 gr. N.A.B. 6 D.S.	p O	-	-	n O	n O	N HI		
50	Severe rhinitis, generalised rash at 3 months. Baby and sister POSITIVE.	6	1.3 gr. N.A.B. 6 D.S.	n O	-	n O					
60	Hydrocephalus at 8 months. Baby, mother and father POSITIVE.	11	1.1 gr. N.A.B. 6 D.S.	-	n O	n O					
61	Severe rhinitis, generalised rash, osteochondritis left femur at 3 months. Baby and sister POSITIVE.	4	1.7 gr. N.A.B. 6 I.V.	n O	-	n O	-	N HI	N HI		
65	At 7 weeks, widespread rash, peeling palms and soles. Mother, father and baby POSITIVE.	2	1.7 gr. N.A.B. 6 D.S.	p O	-	n O	-	N HI	N HI	n O	N HI
66	At 3 months, severe rhinitis, dusky, scaly, circinate, generalised rash. Mother negative, baby and father POSITIVE.	4	1.8 gr. N.A.B. 6 D.S.	p O	-	-	-	N HI	n O I		
68	At 2 months, generalised rash. Mother and baby POSITIVE.	4	1.3 gr. N.A.B. 6 D.S.	-	-	-	-	n O	N HI	n O	N HI
69	At 8 weeks, rose red maculopopular, circinate desquamating rash on scalp, trunk and limbs, not affecting flexures. Peeling palms and soles. Rhinitis. POSITIVE.	8	0.6 gr. N.A.B. 3 D.S.	-	-	n O	-	-	n O	-	n O I (2 1/2 years)
79	At 4 weeks, generalised rash still present at 4 months. Rhinitis, mucous patches and rhagades, POSITIVE.	4	1.1 gr. N.A.B. 4 D.S.	n O	N HI	n O I	n O I				

TABLE I.

SERIAL NUMBER	NATURE OF EVIDENCE UPON WHICH DIAGNOSIS IS BASED	AGE IN MONTHS	TREATMENT	Within 6 weeks to	6 weeks 3 months to	3 months 6 months to	6 months 9 months to	9 months 1 year to	1 year 1 1/2 years to	1 1/2 years 2 years to	2 years to 2 1/2 years
35	At 2 months, POSITIVE. Gross mental and physical retardation and enlarged spleen at 10 months. Again POSITIVE.	16	2.1 gr. N.A.B. 6 D.S.	p O	n O	-	n O	n O	-	N HI	
43	At 6 weeks, papular rash, rhinitis. At 18 months, leucoporenia left arm and general retardation. Mother also POSITIVE.	19	1.8 gr. N.A.B. 6 D.S.	-	n O	-	n O	N HI	n O	N HI	
47	Ulceration angle of mouth for six months, disappeared after first injection. POSITIVE. Mother PARTIAL.	23	1.6 gr. N.A.B. 6 D.S.	n O	-	n O	n O	-	N HI	N HI	
81	Stitlock rash, rhinitis, restlessness at 2 months. Father, mother and baby at 21 months POSITIVE.	41	2.4 gr. N.A.B. 6 D.S.	-	-	n O	n O	-	-	n O I	N HI
8	Rhinitis, infiltrated rash at 10 weeks. POSITIVE. Two crops of condylomata during year. Mother also POSITIVE.	42	1.4 gr. N.A.B. 6 D.S.	-	n O						
95	Illegitimate, jaundice at 11 days, condylomata, hoarse cry, chronic bronchitis at 19 months. Mother also POSITIVE.	40	1.8 gr. N.A.B. 6 D.S.	-	-	-	-	-	-	n O	N HI
78	Rhagades, rhinitis at 2 months. Mother POSITIVE. Gross mental and physical retardation at 10 months. POSITIVE.	10	1.5 gr. N.A.B. 6 D.S.	-	-	-	-	-	n O	n O	n O (3 yrs)
100	Generalised rash at 3 months. POSITIVE then and at 7 months. (Mother NEGATIVE when baby 6 months.)	41	1.6 gr. N.A.B. 7 D.S.	-	-	n O	-	n O	-	-	n O (3 yrs)

TABLE II.

SERIAL NUMBER	NATURE OF EVIDENCE UPON WHICH DIAGNOSIS IS BASED	AGE YRS MTHS	TREATMENT	Within 6 weeks to 6 weeks	3 months to 3 months	6 months to 6 months	9 months to 9 months	1 year to 1 year	1 1/2 years to 1 1/2 years	Over 2 years to 2 years
1	Rhinitis, no rash, Condyloma ani at 18 months. Mucous patches mouth at 2 years. POSITIVE then, and at 3 years 4 months.	3 6	2.1 gr. N.A.B. 6 D.S.	PHI	-	n O	N HI	N HI		
3	Disseminated chorioiditis at 10 months. POSITIVE. Mother also POSITIVE. Buccal mucous patches, hoarse voice, chronic bronchitis and again POSITIVE at 3 years.	3 5	2.2 gr. N.A.B. 6 D.S.	p O	-	n O	N HI	-	N HI	
9	Osteochondritis femur at 3 weeks. At 23 months baby and mother POSITIVE.	2 4	1.1 gr. N.A.B. 4 D.S.	-	-	-	n O	-	-	n OI
11	Rhinitis, generalised rash at 3 months. At 21 months only and older sister POSITIVE. Again POSITIVE at 3 yrs 10 mths	3 11	1.0 gr. N.A.B. 6 D.S.	-	n O	-	n O	-	-	n O
14	Father G.F.I., older brother POSITIVE, with lesions. Patient free of lesions but POSITIVE at 3 years 7 months.	3 6	2.1 gr. N.A.B. 6 D.S.	p O	-	n O	D HI	N HI	n OI	
16	Older and baby at 4 months POSITIVE. Condyloma ani at 10 months. POSITIVE at 13 months and again at 4 years.	4 0	3.0 gr. N.A.B. 14 D.S.	n O	-	-	n O	-	d O	N HI
12	Chronic ulceration lens at 5 years POSITIVE. Brother, gross lesions and also POSITIVE.	7 3	1.3 gr. N.A.B. 6 D.S.	-	-	n O	-	-	d O	N HI
29	Pen, rhinitis, convulsions and rhabdomyolysis at 3 weeks. Scarring attacks. POSITIVE at 4 years. Mother and brother POSITIVE.	4 7	1.5 gr. N.A.B. 6 D.S.	-	-	-	d O	n O	-	n OI
39	Serolal Condylomata at 3 yrs 4 months. POSITIVE. Mother POSITIVE and brother POSITIVE on two occasions.	3 3	1.5 gr. N.A.B. 6 D.S.	n O	-	-	-	-	n O	N HI
44	Parasitic left leg with irregular hoarseness of tibia. POSITIVE. Older brother and mother also POSITIVE.	6 1	2.9 gr. N.A.B. 6 I.V.	p O	-	-	n O	-	n O	N HI
56	Generalised rash at 8 months. Diarrhoea left eye, chronic ulceration at 2 1/2 years. POSITIVE. Older and older sister also POSITIVE. General retardation.	3 11	3.45 gr. N.A.B. 12 D.S.	n O	n O	-	n O	-	n O	N HI

TABLE III.

Tables III. and IV. present the essential details of twenty case histories of children over the age of two years at the time of the first injection who are apparently cured and of four others of the same age grouping in which the serological findings are favourable soon after the courses of injections.

SERIAL NUMBER	NATURE OF EVIDENCE UPON WHICH DIAGNOSIS IS BASED	AGE YRS MTHS	TREATMENT	Within 6 weeks to 6 weeks	3 months to 3 months	6 months to 6 months	9 months to 9 months	1 year to 1 year	1 1/2 years to 1 1/2 years	Over 2 years to 2 years
5	"Infantile" paralysis at 1 1/2 years. Apart from deformity in apparent good health. POSITIVE at 7 years, and twice at 9 yrs.	9 8	3.2 gr. N.A.B. 6 I.V.	n O	-	d O	-	n O	-	d OI
10	No lesions or stigmas. Gonococcal vulvovaginitis at 7 years. Twice POSITIVE. Father addicted to alcohol.	7 4	2.7 gr. N.A.B. 6 D.S.	n O	-	-	-	-	-	-
32	Generalised rash at 7 weeks. Mother POSITIVE. Repeated chronic bronchitis. POSITIVE at 4, 5 and 10 years of age.	8 8	2.0 gr. N.A.B. 6 D.S.	d O	n O	-	-	-	-	-
76	Father known to have had gonorrhoea. Child 6 weeks oroture. Ophthalmia. Telos. Repeated bronchitis. Conjunctivitis. Stable febrile attack. POSITIVE.	12 1	2.4 gr. N.A.B. 6 I.V.	n OI	-	-	N HI	-	-	-
90	Cribriformly asperited at 5 years. Had gonorrhoea. Twice POSITIVE at 8 1/2 years.	8 7	4.4 gr. N.A.B. 6 D.S.	n O	n O	d O	-	N HI	d O n I	-
94	Father alcoholic, gonorrhoea. Child POSITIVE at 7 years 10 months.	9 8	4.1 gr. N.A.B. 6 D.S.	n O	-	-	N HI	N HI	N HI	-
96	Severe attack of ititis each year for four years. Three times POSITIVE at 8 years. Older and brother dead.	8 9	5.7 gr. N.A.B. 10 I.V.	N HI	-	-	-	-	-	-
101	Generalised urticarial rash annually for years. Twice POSITIVE at 1 1/2 years.	11 7	5.7 gr. N.A.B. 10 I.V.	N HI	N HI	n OI	-	-	-	-
102	Phagedenic ulceration of face and body with deep scarring. Recurrent for six months at 8 years. POSITIVE.	6 5	2.9 gr. N.A.B. 6 I.V.	N HI	-	-	N HI	-	-	-
103	"Eczema" on abdomen when a few weeks old. Mother also had it in previous year. Congenital factor, recurrent bronchitis. Physical and mental retardation. POSITIVE.	8 0	2.4 gr. N.A.B. 6 D.S.	N HI	N HI	n OI	-	-	-	-
104	No lesions referable to syphilis. General under-development. Twice POSITIVE at 7 1/2 years.	7 8	3.3 gr. N.A.B. 6 I.V.	n OI	n OI	N HI	-	-	-	-
15	Anisocoria, disseminated chorioiditis, mental and physical retardation. POSITIVE. Father G.F.I. Mother and brother also POSITIVE.	6 5	2.1 gr. N.A.B. 6 D.S.	-	-	n O	D HI	N HI	n O	d OI
82	No lesions or stigmas. Twice POSITIVE at 3 1/2 years. Father contracted syphilis 20 years ago. Still POSITIVE. Previous child lived only 10 hours.	3 7	1.7 gr. N.A.B. 6 D.S.	d O	-	-	n O	N HI	-	-

TABLE IV.

30, 38, 61, 63, 68 and 80), are still apparently free of the disease, eighteen months to two years afterwards. Nine babies received less than one gramme, four of them died and only one (No. 46) is apparently cured. Tables I. to IV. epitomize the case histories of four of the babies whose response to treatment has been most gratifying, and show how promptly the lesions disappeared, what auxiliary treatment was used, the growth curves of the babies compared with the normal, the failure of the sera to yield the Wassermann reaction after treatment and other points of interest.

TABLE 5. PROGRESS REPORT, Summary of Results of Treatment of Ninety-Five Syphilitic Infants and Children by Injections of Nov-arseno-billon (N.A.B.).

Age of Children at time of first injection	Total number of children who are cured	Number of children who are progressing	Number of children who are not progressing	Number of children who are dead	Number of children who are still-born	Number of children who are living	Number of children who are dead	Number of children who are still-born	Number of children who are living
Under One Year									
More than One Gramme	11	0	0	0	1	11	0	0	11
Less than One Gramme	1	3	1	0	4	9	0	0	9
Between One and Two Years									
More than 1.5 Grammes	7	1	0	0	1	8	0	0	8
Less than 1.5 Grammes	0	0	1	0	0	1	0	0	1
Three to Four Years									
More than Two Grammes	4	0	0	0	0	4	0	0	4
Less than Two Grammes	4	1	0	0	0	5	0	0	5
Five to Six Years									
More than 2.5 Grammes	4	0	0	0	0	4	0	0	4
Less than 2.5 Grammes	4	0	0	0	0	4	0	0	4
Seven to Eight Years									
More than Three Grammes	3	0	0	0	0	3	0	0	3
Less than Three Grammes	1	0	0	0	0	1	0	0	1
TOTALS	29	2	1	0	0	32	0	0	32

TABLE V.

A summary showing the results of the treatment of ninety-five indubitably syphilitic children by means of "Nov-arseno-billon."

If a baby survives the first year without treatment, it may be freed from clinical and serological evidence of disease. Seven of those that I have treated in the second year of life (Nos. 35, 42, 47, 78, 81, 95 and 106), all received more than one gramme, fifty centigrammes of "Nov-arseno-billon" and are apparently cured. One (No. 48) died of acute infective colitis and one (No. 70) was transferred to another clinic, but the serum yielded the reaction three months after the injections. The only other patient in this group (No. 8) had very scattered injections amounting to one gramme, forty centigrammes and the serum practically failed to yield the reaction when I saw her last.

It is unquestionable that "Nov-arseno-billon," if used in the dosage indicated above, is capable of ridding a large majority of the babies and many young children of all detectable evidence of the disease including the reaction of the serum to the modern modifications of the Wassermann technique.

This, however, is not the case with most of the patients over four years of age and though clinical improvement has been manifested in many of these children and the disease has only progressed in a few examples of severe visceral and cerebro-spinal syphilis, one feels that their treatment is not on a satisfactory footing.

The deduction that I wish to make from a consideration of the progress results (Table V.), is that, if possible,

congenitally syphilitic children should be treated by means of injections of a satisfactory arsenical preparation in the first year or two of life and that this treatment should not be omitted or postponed. It should be our aim to assist the legislators to devise a scheme for the early diagnosis and thorough treatment of all the affected people in the families that are known to contain at least one congenital syphilitic child.

Conclusion: The Wastage of Syphilis.

Certain features predominate in syphilitic family histories and their presence in a particular history should prompt the serological investigation of that family. These features are still-births, deaths of infants in the first month and deaths in childhood.

Table VI. shows the results of my inquiry into this matter. The mothers of children attending the Children's Hospital may be taken as representative of the poor class of women of this community and there is only an average probability of gynaecological trouble. The histories have been elicited personally or at my instigation to insure accuracy and completeness. The addition of an extra two hundred histories does not materially affect the ratios calculated from one hundred histories of families not known to be syphilitic, so it may be inferred that conclusions may be drawn from an analysis of so few as one hundred histories of syphilitic families. These conclusions are that still-births occur about four times as often in syphilitic families as in average families and that three times as many children die in the first month in syphilitic families as compared with the other group; it is twice as common to find that children have died in the former group as it is in the latter.

TABLE 6. A COMPARISON OF DETAILS OF FAMILY HISTORIES in Syphilitic Families and in Families not known to be Syphilitic.

PERCENTAGE RATIO	NUMBER OF SYPHILITIC FAMILIES				NUMBER OF FAMILIES NOT KNOWN TO BE SYPHILITIC.			
	25	50	75	100	25	50	75	100 300
of number of children born alive to total number of pregnancies	72.7	71.5	71.6	74.7	85.9	84.5	86.3	84.3 85.8
of number of children dead, in childhood, at the time the history was taken to the total number born alive.	22.7	24.8	23.9	22.0	11.2	10.8	11.6	12.3 11.1
of number of children dead in the first month of life to the total number born alive.	7.9	9.8	9.7	8.6	1.7	2.3	2.3	2.7 2.9
of the number of still-births to the total number of pregnancies	13.2	12.8	10.7	9.7	2.2	3.5	2.8	2.9 2.2
of the number of miscarriages and abortions to the total number of pregnancies	14.0	15.7	17.7	15.6	11.8	11.9	11.0	12.7 11.8
NUMBER OF PREGNANCIES	121	242	345	474	135	252	390	521 1598
NUMBER BORN ALIVE	88	173	247	354	116	213	336	439 1372
Percentage ratio of ante-natal and post-natal deaths to the number of pregnancies ("Wastage")								
Syphilitic Families	41.9							
Families not known to be syphilitic					23.7			

TABLE VI.

If the wastage of child life be defined as the percentage of pregnancies which either do not produce a living child, or result in the birth of a child that dies in childhood, the wastage of syphilitic families in this community would appear to be about 42% as compared with an average wastage of 23%. It is of interest to note that these figures are intermediate between Jeans and Butler's American ones for a hundred families and Bishop Harman's English ones for one hundred and fifty families (Table VII.).

TABLE I. WASTAGE OF SYPHILITIC FAMILIES.

Observer	Syphilitic Families.	Families not known to be syphilitic.
Jeans and Butler	40.0%	25.5%
Graham	41.9%	23.7%
Bishop Harman	40.05%	20.80%

In the hundred syphilitic families I have summarised there were 474 pregnancies, one only in each of seventeen of them; there resulted 354 children, of whom 79 died in childhood, (twenty-seven in the first month). Of the 275 living children 115 are known to be syphilitic, 10 have no stigmata and their sera do not yield the Wassermann reaction and the others have not been examined. In addition there are 74 miscarriages and abortions and 46 still-births and some of the mothers admit that they have avoided pregnancies on account of the risk of bearing syphilitic children.

TABLE VII.

Efficient ante-natal and early post-natal treatment is capable of doing so much for the innocent victims of this social scourge that I think that we who realize this, should do all that lies in our power to put it into operation and, in addition, should advise the law-makers to tighten up the laws in existence and, in particular to legalize and facilitate the compulsory serological investigation of the mother, father, sisters and brothers of a known congenital syphilitic person in order that such as prove to be syphilitic may receive the benefits to be derived from treatment.

Acknowledgements.

I am deeply grateful to Miss F. E. Williams at the Walter and Eliza Hall Institute for Research and to Dr. R. H. Bull and his assistants at the Melbourne University Bacteriological Laboratory for doing the enormous amount of careful serological work that the blood examinations have entailed for them.

CONGENITAL SYPHILIS.

By J. B. DOUGLAS GALBRAITH, M.D. (Glasgow),
Brunswick. Victoria.

I should wish to congratulate Dr. Graham on the thorough and painstaking way in which he has carried out his work on the treatment of congenital syphilis and on the results he has placed before you.

The treatment of congenital syphilis with the arsenical preparations was long thought to be dangerous, even by such an authority as Ehrlich, but it has now been placed on a sound basis and Dr. Graham's figures with "Nov-arseno-billon" show how successful such treatment can be. My contribution to the discussion will be to give you a brief summary of results I have obtained with two other preparations, namely "Sulfarsenal" and "Neo-kharsivan."

The work was carried out at the Royal Hospital for Sick Children, Glasgow, under the direction of Leonard Findlay, who is well known as a pioneer in the treatment of congenital syphilis. Altogether during the course of a year I treated about sixty children. In all cases the injections were supplemented by mercurial inunction. Dr. Graham and other observers, notably Fildes and Darrell, have concluded that the administration of mercury along with the arsenic preparations does not in any way hasten the cure of the disease. Still it is difficult to rid one's mind of the notion that since each of these drugs will *per se* have a curative effect, a combination of the two will have an even greater effect. So far as infants are concerned, at any rate, I am convinced that mercury applied by inunction has a much more evident therapeutic effect than when the drug is administered by mouth.

"Sulfarsenal" is particularly well suited, for private practice because, in contrast with "Nov-arseno-benzol" and "Neo-kharsivan" its deep injection causes very little pain. Only in rare instances have I seen abscess formation follow its use. It has also been noticed that complications such as dermatitis and jaundice are less likely to occur when "Sulfarsenal" is used. The site I used for injections was that suggested by Marian Mackenzie, a finger's breadth below the crest of the ilium and in a line with the great trochanter. The course I gave consisted of seven weekly injections, with an average total amount of drug of two grammes.

"Neo-kharsivan" was always given intravenously, seven weekly injections, again are giving, in all about two grammes of the drug. In several instances I gave adult doses (0.6 gramme) to infants a few months old and have never seen any ill results. In fact the low toxicity of the modern preparations as compared with the old "Salvarsan" and "Kharsivan" is very striking, but unfortunately their therapeutic effect is also considerably less. In these intravenous injections I followed the practice of Dr. Findlay in using the scalp veins and only used the longitudinal sinus as a last resource.

Results.

In children up to one year "Sulfarsenal" intramuscularly gave as good results as similar intravenous doses of "Neo-kharsivan." But neither gave such good results as Dr. Graham has laid before you to-day. The average number of injections required to render serum incapable of reacting in the Wassermann test was fourteen with a total dosage of four grammes of the drug. Several babies had twenty-one injections, with about eight grammes of the drug before the power to react disappeared.

Even in infants under three months of age only in three out of nine did the serum lose this power after seven injections of "Sulfarsenal" and with Neo-kharsivan the serum continued to react in all seven.

During the second year only 20% of the children treated with "Sulfarsenal" failed to yield reactions after fourteen injections and 50% of those treated with "Neo-kharsivan." During this period "Neo-kharsivan" gave better results than "Sulfarsenal" and compared with the "Nov-arseno-billon" figures, both drugs were disappointing. In children over four years of age I had great difficulty in causing the power to react to disappear. Those few whose serum did not react had had a long course of "Neo-kharsivan."

To summarize, in babies under one year "Sulfarsenal" gives as good results as "Neo-kharsivan"; over one year the advantage lies the other way. And, neither drug, at any period, is as good therapeutically as "Nov-arseno-billon" in the treatment of congenital syphilis.

I should like to emphasize Dr. Graham's findings that the younger the child, the more amenable the disease is to treatment, and that after four years it is difficult to alter the response to the Wassermann test. The question has been raised whether it is worth while going on treating these congenital syphilitics whose serum persistently yield a Wassermann reaction. I think it is because, when the test has been carried out quantitatively, it has been found that, whilst the serum still retains the power to react, the degree of positivity gradually diminishes with treatment.

Dr. Graham's observation that although the response might be positive at the end of treatment it frequently disappears within three months without further treatment is of great interest. But I think that the failure to react to the Wassermann test after a small amount of arsenic should not beguile us into a false confidence that we have cured the disease. It is very necessary, as Dr. Graham has pointed out, that these children be carefully watched for several years and personally I would favour giving a course of injections once a year for three or four years in spite of the failure to induce the reaction. Findlay describes two patients treated in infancy to a negative W.R. until the serum no longer reacted, returning at six years, one with condylomata and the other with keratitis.

Ante-Natal Treatment.

Although the results of treatment of congenital syphilis are fairly satisfactory, so far as infants are concerned, they are still far from being as good as when ante-natal treatment is instituted. This is undoubtedly the ideal method. Adams, Findlay and others have obtained healthy babies in 100% of their cases. Personally, I have only treated five pregnant women. One had only four injections, and her baby's serum gave a Wassermann reaction. But the other four babies were healthy in every respect. This ante-natal work lies particularly within the province of the family doctor, and I hope the day will come when we shall carry out the complement fixation test as a routine on every pregnant woman under our care, just as, at present, we examine the urine. Those of us who are in general practice realize that to attempt to perform a Wassermann test with the serum of all collaterals of every patient with congenital syphilis who comes under our care would simply mean the loss of many of our patients. Nor do I think much material benefit would ensue. In the elder children with congenital syphilis the damage has already been done and they respond very poorly to treatment. Moreover, we know that except in very exceptional cases congenital syphilis is not infective and that no authenticated case of transmission to the third generation has ever been recorded. Therefore I think we should concentrate our attention on the mother—the potential producer of more syphilitic children. Should we be unable to obtain a specimen of blood during the pregnancy, we can unostentatiously obtain it at the confinement and if it yields a reaction, we can institute treatment immediately. If this were done, together with a similar procedure at the hospital, ante-natal clinics, as Fowler has recommended,

and the notification of miscarriages, we should then be on the fair way to controlling congenital syphilis. A very much larger public health grant would be needed for the laboratory work and if the doctor were paid half a crown by the State for every specimen of blood sent in, as is the case in Scotland, the busy practitioner would have some recompense for the time occupied in obtaining the specimen. But he would have the much greater incentive of knowing that he was doing his best towards wiping out a very great and very deadly pestilence.

DR. E. H. MOLESWORTH spoke from his experience in the treatment of congenital syphilis at the Royal Prince Alfred Hospital, Sydney. He had always been rather cautious in the matter of giving large doses of arsenical preparations and 0.1 gramme of "Nov-arseno-billon" was the largest dose he gave to any individual child. He had used the site of injection suggested by Dr. Galbraith and had been troubled by very few abscesses. The child was always made an in-patient for the purpose of receiving a course of injections. He was not satisfied that there was any particular value in simultaneous mercurial treatment.

Too much importance could not be attached to ante-natal treatment. When the mother was under supervision and treatment throughout her pregnancy, it rarely happened that the baby reacted to the Wassermann test and further serum of the child generally did not regain the power to react. Arsenical treatment should be instituted at the very earliest age. He suggested that bismuth preparations and "Trépol" would be found very useful in dealing with patients harbouring so-called Wassermann-fast spirochaetes. Dr. Molesworth concluded with some remarks on the economic importance of the adequate treatment of congenital syphilis.

DR. HARVEY SUTTON asked at what age as a rule syphilitic lesions appeared. Was there any time limit of infectivity of congenital syphilis? Congenital syphilis was probably an underlying factor contributing to the severity of many other infections.

DR. H. DOUGLAS STEPHENS asked if Dr. Graham had any experience of ill effects following the injection of arsenical preparations. He recollected one child in whom severe keratitis followed an injection of "Nov-arseno-billon" and another who developed acute synovitis of the knee-joint after an injection. Were these conditions due to the elimination of spirochaetal toxins or to the arsenic itself? Was an interval necessary after six or seven injections? Dr. Galbraith apparently had gone straight ahead until as many as fourteen injections had been given. With reference to the results ensuing in the absence of treatment Dr. Stephens quoted the case of a boy, who without having manifested any previous indications of congenital syphilis, developed double syphilitic synovitis at the age of six years. His blood serum at that stage was found to give a reaction to the Wassermann test, but the parents would not give their consent to a course of arsenical injections. He saw the boy again when he had reached the age of twelve years and he was then a moral imbecile, although he did not display any clinical indications of syphilis. He had received no treatment in the mean time, but at the later period his blood failed to give a reaction when the Wassermann test was applied. Although there was no true record of transmission of syphilis to the third generation, he felt that it was possible that congenital abnormalities such as cleft palate, hare-lip, Mongolian imbecility, might be dependent upon

this cause. In his experience the blood of infants under three months of age reacted to the Wassermann test very infrequently.

DR. S. W. FERGUSON, speaking with reference to children with undoubted syphilitic stigmata, said that he had found the oral administration of "Hydrarson" a satisfactory method of treatment but he did not advocate it as replacing intensive treatment.

DR. A. P. DERHAM referred to mental retardation in congenital syphilis. He had had the supervision of 800 wards of State and found that positive findings by the Wassermann test were obtained with greater frequency from those children who were below par mentally than from those whose mental development was up to standard.

A brief reply by Dr. Graham terminated the discussion.

SURGICAL TREATMENT OF INFANTILE PARALYSIS.

By A. V. MEEHAN, M.B. (Sydney), F.R.C.S. (Edinburgh)
Honorary Orthopaedic Surgeon, Base Hospital for Sick Children, Brisbane General Hospital and Repatriation General Hospital, Brisbane.

OF the many surgical conditions in infantile paralysis which can be improved by operative measures, I have for the purposes of this paper selected two only. I feel that it will be far better to describe these in some detail than to attempt to cover a bigger field in a cursory manner.

The conditions which I have selected are (i.) complete deltoid paralysis and (ii.) the flail foot, that is the foot which, as a result of paralysis of practically every muscle below the knee, is incapable of serving its purpose as a support at all.

My reasons for this selection are firstly that these two conditions are very common, secondly, that they give rise to very serious disability and thirdly, that the results of the operative measures which I will describe have been very gratifying and have led to very substantial improvement.

The operations which I favour in these two conditions and for the good results of which I can vouch, are for complete deltoid paralysis arthrodesis of the shoulder joint with fixation of the head of the humerus to the acromion by means of a tibial bone-graft peg according to Albee's method; for the flail foot astragalectomy with backward displacement of the foot by Whitman's method.

GENERAL INDICATION FOR OPERATION.

The indication for operation which I have adopted, is that the affected muscles are completely and permanently paralysed. In every case I have been satisfied that this indication for treatment has been present and in arriving at this conclusion, I have placed no reliance whatever on electrical tests or on the reaction of degeneration, but have applied the following test which we may call the time test.

In a recent case of infantile paralysis I have made sure that the paralysed muscles are prevented from stretching by means of appropriate splints and receive massage and daily encouragement of voluntary contraction for a period of two years from the onset of the disease. If, at the end of this period, the paralysed muscles showed any voluntary power, I have persisted in muscle support and re-education. If, on the other hand, no voluntary power was present

in the muscles after two years, I have advised operation.

In patients seen within the period of two years from the onset, in whom adequate treatment had not been received, I have carried out rest, massage and encouragement of active movement until the period of two years from the onset had elapsed.

In patients seen more than two years after the onset, in whom adequate treatment had not previously been received, I have held my hand for three months during which time splinting and appropriate treatment have been carried out; only in those who after these measures showed no trace of voluntary power, have I resorted to operation.

SPECIAL INDICATIONS FOR OPERATION.

Complete Deltoid Paralysis.

Operation is indicated in cases where the muscles responsible for the movements of the scapula (other than the deltoid) have strong voluntary power, sufficient to carry the scapula and the arm with it through the various movements necessary in performing the ordinary shoulder movements of every day life. In this respect the trapezius and *levator anguli scapulae* are the most important muscles in elevating the arm after arthrodesis and the rhomboids and *serratus anterior* are mostly responsible for backward and forward movement of the arm respectively.

The requirements in this connexion should be that the affected shoulder can be strongly shrugged upward and braced backward against firm resistance. If these conditions are not fulfilled, a course of re-educational exercises for the muscles acting on the scapula should be given and unless this results in the trapezius and rhomboids developing practically normal power, the operation will lead to disappointment.

It is obvious that the scapula must be perfectly mobile upon the chest wall for any improvement to result from operation.

It is of extreme importance to remember that the main function of the upper limb is a prehensile one and this function is performed solely by the hand, the arm merely acting as a lever to bring the hand into any position required for prehension. Hence, it is an axiom that a useless hand means a useless arm and if the hand is useless, it obviously will not be any advantage to the patient to be able to place the hand where he wants it. Accordingly operation on the shoulder should not be performed unless the hand is a useful one.

If the elbow joint is a flail one, arthrodesis of the shoulder should be preceded by an arthrodesis of the elbow joint in a useful position, but it is not wise to do both operations within the period of bone growth on account of the risk of injuring both humeral epiphyses and so interfering with the growth in length of the arm.

The Operation.

The shoulder joint is opened through the anterior incision of Ollier and the head of the humerus is made to protrude through the wound. A crucial incision is made through the cartilage well down on to the bone. The four quarters of the cartilage are then chiselled free from the bone, a thin layer of vascular bone being removed with the cartilage. With the head still protruding the glenoid can be readily seen and treated in a similar manner. The synovial membrane is now systematically removed with

sharp pointed scissors and then the head of the humerus is replaced.

A small U-shaped incision is now made over the upper surface of the acromion and with the arm held abducted to 90° and slightly flexed forward at the shoulder joint, a small sharp gouge is passed through the acromion and head of the humerus and left in position. A bone graft is now removed from the inner surface of the tibia of the same size as the gouge and tapering a little from one end to the other. The narrow end of the graft is pointed with nibbling forceps and, while the arm and scapula are held steadily, the gouge is withdrawn from the acromion and head of the humerus and is replaced by the graft which is hammered firmly home, the protruding thick end of the graft being sawn off with a small saw.

The arm and chest are now put up in a firm plaster with the arm abducted to 90° and inclined slightly forward at the shoulder. When the plaster is set, a small window is cut to allow inspection of the wound.

After Treatment.

The patient is kept in bed for two or three weeks and then allowed to walk about. Six weeks after the operation the cast is made into a removable splint and in all my series of cases so far firm bony union has been present at that time and the patient has been able to abduct the arm voluntarily to a right angle. The splint is worn for another fortnight being removed daily for active exercises and at the end of another fortnight it is usually safe to discard all support. Exercises and massage are continued until all movements are free and strong.

Mechanism of the After Result.

The results are striking, inasmuch as a patient whose arm hangs helpless at the side, is within six weeks of operation able to raise the arm to shoulder level and as time goes on recovers most of the other movements of the arm. The mechanism by which this is brought about is quite simple. After the arthrodesis the humerus and scapula are fused into a single bone, shaped like a hatchet; the fusion is augmented by the peg graft which unites the acromion process of the scapula to the upper part of the handle of the hatchet. To the various borders of the blade of the hatchet strong active muscles are attached, the most important one for the movement of abduction being the trapezius.

When the arm is allowed to fall to the side, the attached humerus drags the outer end of the scapula downward and rotates it downward and inward. This puts the trapezius muscle slightly on the stretch so that it is "at the ready" all the time to raise the outer part of the scapula and rotate it upward and inward. As a result when the patient is asked to raise his arm from the side, he contracts his trapezius and instead of this action producing merely a shrugging of the shoulder as it did before operation, the humerus is carried upward with the scapula and often to the utter astonishment of the patient when he does it for the first time, the arm is briskly abducted from the side. This mechanism acts in an exactly similar way to produce the other movements at the shoulder, the blade of the hatchet, to resume the simile, being actuated by the muscles attached to it and these movements being transmitted to the handle of the hatchet as a result of the firm ankylosis present.

Reports of Cases.

The series consist of six patients of whom one developed an intercurrent infectious condition a fortnight after operation and is not at present available for report; the other cases are reported below.

Case I.—S.C., eleven and a half years old at date of operation, had infantile paralysis at the age of eighteen months. The right deltoid muscle was completely paralysed. No other serious paralyses were present. Operation was performed on May 23, 1922; arthrodesis of shoulder joint with insertion of bone graft. On May 25, 1922, the hand was swollen and painful; the circulation was not good in the hand. The plaster was cut down along the whole length of the arm and the incision in the plaster widened. On May 26, 1922, there was no relief; the hand was blue, swollen and partly anæsthetic. The plaster was completely removed and an aeroplane splint applied. On July 6, 1922, the splint was taken off. The shoulder apparently firmly ankylosed. The patient could raise his arm briskly to 90°. His hand was still partially anæsthetic and the intrinsic muscles of the hand were almost completely paralysed. The hand was put on a splint to keep intrinsic muscles relaxed and re-education of hand muscles was commenced. In October, 1922, the hand had completely recovered power and sensation. The shoulder movement was excellent. X-ray examination showed firm bony ankylosis of the shoulder-joint with fracture of the bone graft. On October 3, 1923, the arm could be moved in all directions, the amount of abduction present being 100°. The ischæmic condition which developed immediately after the operation was due to the fact that sufficient padding was not inserted under the axilla and when swelling occurred after the operation, the axillary vessels were subjected to severe pressure. The bone graft used was probably not bulky enough. In spite of these complications the result is classed as excellent, and to the lay observer it is hard to find anything wrong with the child.

Case II.—A.L., aged seven years at the date of operation, had infantile paralysis at the age of one year and eight months. There was complete paralysis of deltoid with weakness of the triceps. The hand was useful, although hand movements were weak. Operation was performed on September 4, 1922, arthrodesis of the shoulder with insertion of a bone graft. On October 20, 1922, the plaster was removed. The patient could raise arm to 90° from the side. There was excellent movement of arm. On September 29, 1923, the patient could abduct arm beyond 90° and could touch the side of his head above the ear. The triceps muscle was still weak. All the movements of the hand were strong.

Case III.—J.S., aged twenty-seven, a clerk, had both arms paralysed since infancy. His left arm had very little power in the biceps and the triceps and the hand and finger movements were poor. The deltoid was completely paralysed. The trapezius was weak and the rhomboids were not working strongly. The right arm showed complete paralysis of the deltoid. No other important paralyses were present in this arm. Operation was performed in November, 1922, arthrodesis of the right shoulder joint with insertion of a bone graft. Six weeks after operation the patient without difficulty could voluntarily abduct the arm to 90°. Three months after his operation he returned to work. In October, 1923, abduction to 100° was present at the shoulder with very good movement in all other directions. The patient is very gratified and wishes to have the other shoulder operated upon. He is having a course of exercises with a view to improving the condition of left shoulder and to possible operation. In his work he has to remove and re-

place heavy books on high shelves and he is now able to do this without any difficulty.

Case IV.—R.C., nine and a half years old at the date of operation, had infantile paralysis at the age of one year and five months. The left arm and left leg were affected. He had a paralysed left deltoid muscle. The flexors and extensors of the elbow were working, but were weak. Pronation and supination were also weak and the hand grip was not strong. The trapezius muscles, the rhomboids and the *seratus magnus* muscles were acting strongly. The right foot had no muscles acting except the peroneals and intrinsic muscles of the foot. The first operation was performed in October, 1922, arthodesis of the shoulder with insertion of a bone graft. The second operation was done one month later, astragalectomy of the left foot. The shoulder plaster was removed six weeks after the operation at which time the patient could voluntarily abduct arm to a little less than 90°. The patient was allowed to walk three months after astragalectomy. During this period exercises were carried out for all the arm muscles. The patient was last seen three months ago when he was walking with a firm foot with practically no limp and could abduct the arm to 90° and touch the back of his head and forehead. The rest of the arm muscles had improved a good deal, particularly the intrinsic muscles of the hand.

Case V.—R.P., aged six years, had infantile paralysis about two years previously. On January 31, 1921, the left deltoid was paralysed, the trapezius was acting well. The rhomboids were acting well. The elbow movements were weak, but all present. The hand was in good condition, except that the *opponens pollicis* was paralysed. The patient was given an abduction splint and re-education was carried out until admission to hospital. The patient developed variella after admission and was finally operated upon on August 13, 1923, on which date arthodesis of left shoulder was performed with insertion of a bone graft. The plaster was removed seven weeks after the operation and the patient could immediately abduct arm to 90°. The patient is having exercise at present. This patient is shown to illustrate the rapidity with which improvement is obtained by this operation.

The Flail Foot.

Special Indications for Operation.

The ideal case is the one in which practically all the muscles below the knee are paralysed, but otherwise the limb is a sound one, but the operation is a useful one in many cases which are more extensively paralysed.

For example, a patient with a flail foot accompanying a paralysed quadriceps and weak or paralysed hamstrings cannot use the limb for progression without wearing a support. In such a case an astragalectomy, by stabilizing the ankle joint in a position of slight *equinus* will sometimes enable the patient to lock his knee in extension or slight hyper-extension and walk surprisingly well without support.

In the case of a flail foot associated with a paralysed quadriceps, in which the hamstrings are strong, a combination of astragalectomy and transference of one or more hamstrings to the patella provides a useful walking limb.

If, however, the whole lower limb has no useful power at the hip, knee and ankle-joints, it is obviously in most cases not beneficial to stabilize the ankle joint when the patient requires a long brace to support the other joints.

Shortening of the leg is not a contra-indication to astragalectomy, even though it is true that the operation produces a little further shortening. If the operation is properly done, the foot locks in a position of slight *equinus* and in actual use of the limb this makes up for the extra shortening produced. Moreover, the stimulus to growth of the limb as a result of the extra use which stability leads to, probably more than makes up for the extra shortening in patients who have not completed the period of growth.

The operation is now too well known and described in current orthopaedic literature to justify a detailed description here, but I propose to deal shortly with a couple of practical points which have proved themselves to be important in the study of my series of cases.

The name of the operation, astragalectomy, is rather misleading and is not by any means a complete definition of the procedure necessary for success. As a matter of fact the removal of the astragalus is merely an incident in the operation which helps to attain the main object in view, namely considerable backward displacement of the foot on the leg and a stable joint between the bones of the leg and those of the foot. When the operation is completed and before the incision is closed, the foot should be displaced so far backward that the outer malleolus rests in a groove chiselled from the outer aspect of the calcaneocuboid joint and the inner malleolus should rest on the inner side of the scaphoid bone. This displacement should be secured without the need for any forcible manipulation of the foot.

The key to the attainment of this object is to sever the whole extent of the external lateral ligament of the ankle joint, cutting well up behind the external malleolus, and to strip the internal lateral ligament up freely from the internal malleolus. If both of these ligaments are not very thoroughly dealt with, they will prevent the all important backward displacement of the foot.

In some of the earlier cases of my series I did not appreciate this point and as a consequence the results are poor by comparison with the later cases.

The second point is the position in which the foot should be put up after operation, apart from the backward displacement. It is very important that about 20° of *equinus* should be maintained and most surgeons also evert the foot. Regarding the eversion I do not think that this should be deliberately aimed at. My practice is where possible to poise the foot on an even keel neither inverted nor everted, but if the bony conformity of the bed in relation to the malleoli makes this difficult, then the foot should be put up in slight eversion; under no circumstances should the foot be inverted. It must be remembered that the internal is much shorter than the external malleolus and so does not form as good a supporting pillar on the inner side of the foot. As a result there is not as much resistance to inversion as to eversion and one has to guard against the development of varus deformity.

Mechanism of the Operation.

By the backward displacement which the operation produces, the foot is made to act as an efficient support and still up and down movement of the foot at the new ankle joint is conserved.

The removal of the astragalus obliterates the sub-astragaloid and astragalo-navicular joints, thus preventing lateral movement of the foot. The lateral movement is further prevented by the fitting of the two malleoli in a socket on each side of the front of the *os calcis*.

Passive flexion and extension of the foot are allowed to a limited extent, but when the patient puts weight on the front of the foot in walking, the new joint locks at a right angle on account of the navicular bone coming hard up against the front of the articular surface of the tibia.

The whole mechanism of the reconstructed foot thus closely resembles that found in the foot of an artificial limb. Instead of a flail-like passive foot we have a foot in which lateral roll cannot occur, and in which up and down movement is controlled and becomes stable as the weight is put upon the fore-part of the foot.

After Treatment.

The foot and leg are freely padded with cotton wool and then encased in a plaster cast. A window is cut in the cast over the wound and the dressings are changed in about a week. Healing usually takes from two to three weeks. The foot is kept in plaster and no weight is put on it for three months. After this period a walking plaster is applied and the patient walks on this for another month. The plaster is now discarded and a strong boot with the heel raised and elongated on the outer side and a leather strip on the outer side of the sole is worn for another few months. During this time the patient is seen often and if any tendency to inversion is present, systematic daily stretching is performed to overcome this.

Twelve months after operation it is safe to allow the patient to walk in ordinary boots.

Report of Cases.

In the years 1921 to 1923 inclusive, forty patients with flail foot were submitted to astragalectomy. Of these patients I have traced and examined twenty-three and have obtained reports from others.

In every report the parents professed satisfaction at the result of the operation.

Below I quote a number of cases of patients whom I have personally examined recently.

As the full reports on each case examined resemble each other closely I have at random selected a few during each year for more detailed description.

Case I.—H.S., a girl aged ten years at the date of operation, had paresis of the gluteal muscles of her left leg. The quadriceps and ham-strings were acting well. All the muscles below the knee were paralysed, except the short flexors of the toes. The foot was quite flail and the child could walk very little without a support. Astragalectomy was done on March 1, 1921. The last examination was made on September 29, 1923. The child then

walked firmly on the left foot without support. There was no lateral movement and the foot was stable. The child dropped the right shoulder in putting weight on the leg, as a result of the gluteal paresis which was still present. The mother stated that since the operation the child did not fall as she used to, but walked firmly and that the foot was stronger.

Case II.—R.Y., aged six years at the date of operation, had infantile paralysis at the age of two years. The left foot was completely flail; there was no other paralysis. Astragalectomy was performed on April 12, 1921. An examination was made on September 29, 1922. The child walked with a slight limp. The foot had not been properly displaced backward and could be pushed up into a calcaneus position. Lateral movement was also present, but the foot did not turn in walking. This case is classed as a partial failure and further operation to secure backward displacement is to be performed. The mother considers the foot improved, inasmuch as the child does not fall as he used to before the operation.

Case III.—K.A., aged eleven years at the date of operation, had infantile paralysis at the age of two years. Paralytic scoliosis was present. The right quadriceps was paralysed; the right foot was flail and in walking the foot turned over into a *varus* position and considerable weight was taken by the external malleolus which had developed an adventitious bursa. Operation was performed on April 19, 1921, astragalectomy. On examination on September 29, 1923, the child was very heavy weighing fifty-four and a half kilograms (8 stone 9 lbs.). The quadriceps was still paralysed. The child walked well with only a slight limp and the weight was taken firmly on the sole of the foot. There was no lateral instability and the foot locked at an angle of 95° with the leg. The mother said that since the operation the foot had been straight and never turned over and the knee did not give way as it used to do. The child could walk slowly for any distance.

Case IV.—N.M., aged ten years old at the date of operation, had infantile paralysis at the age of three years. The left foot showed *calcaneo-cavus* deformity owing to paralysis of *triceps surae*. There was paralysis of other muscles controlling foot, except for slight power in peroneals. The child wore an iron support to prevent the foot from dragging. The glutei and quadriceps were also weak, but not paralysed. Operation was performed in January, 1922, astragalectomy of the left foot. The last examination was made on October 4, 1923. There was good backward displacement of the foot present. No lateral movement of *os calcis* was present. The foot stopped short at 95° when pushed upward and child walked evenly on his heel and toe. The mother stated that the child walked flat on the foot since the operation and could walk much further than he could before.

Case V.—J.B., ten years old at the date of operation, had infantile paralysis at the age of one and a half years. The right foot was quite flail. There was no other paralysis. Operation, astragalectomy, was performed on March 1, 1921. The child walked strongly with a moderate limp. No lateral instability was present, but as a result of insufficient backward displacement the foot did not lock at a right angle. This case is classed as a partial failure, but is a useful foot and further treatment is not suggested. The mother states that "the child walks more firmly since the operation and does not fall over even on slippery ground."

Case VI.—R.K., eight and a half years old at the date of operation. The condition before operation was a paralytic *calcaneo-valgus* of the right foot. The patient walked on the heel which showed a large onion-like bursa and the front of the foot was atrophied. The *tibialis anterior* was acting well and there was very slight power in the peroneals. The *tibialis posterior* was paralysed. Operation was performed in February, 1922, astragalectomy of the right foot. An examination was made on November 4, 1923. The child walked with a barely perceptible limp and walked evenly on the foot. The foot did not turn over. The heel bursa had completely disappeared. When pushed upward the foot locked at 90°. The mother stated that the child was cured as it now walked on the front of the foot as well as the back.

Case VII.—L.W., six years old at the date of operation, had the left foot completely flail. It turned under him in walking. Operation, astragalectomy was performed on August 26, 1922. An examination was made in October, 1923. The patient walked well with a normal up and down action of the foot. The foot did not roll laterally as he walked and when pushed upward it locked at 90°. The mother states that the foot is firm and does not "flop" as it used to do.

Case VIII.—R.H., seen early in 1922, had weak quadriceps, but fair voluntary power in this muscle. All muscles below the knee were paralysed except short flexors of toes. The child walked with the aid of a iron support as the foot turned completely under him without support. Operation was performed on July 3, 1922, astragalectomy. An examination was made on September 20, 1923. The patient walked well without support. He had heel-and-toe walking. There was slight inversion of the fore-part of the foot, but not enough to require treatment. The mother states that the foot does not turn under him and he walks firmly.

Case IX.—S.M., six years old, had infantile paralysis when two years old. The foot was absolutely flail. There was no paralyses above the knee. The limb was shortened by nineteen millimetres (three-quarters of an inch). Astragalectomy was performed on December 18, 1922. An examination was made on March 1, 1923, the foot locked firmly at 95° when pushed upward and was fixed in slight eversion. The child walked well. An examination was made on May 17, 1923. There was no deviation of the foot. He was wearing a firm boot with the sole thickened about 1.25 centimetres. He walked well. On September 29, 1923, he could stand on toes and walked with only a very slight limp.

Case X.—W.D., eleven years of age, was seen in 1922. There was a very severe paralytic *calcaneo-cavus*. Peroneals and toe extensors were acting strongly. The *tibiales* and *triceps surae* were paralysed. He walked with a bad limp. Operation was performed on October 16, 1922, astragalectomy. Walking was allowed in a plaster cast a little earlier than usual, namely from December 4, 1922, on account of the muscular power present. An examination was made on March 8, 1923. He walked well in a stiffened boot with the outer side of the heel and sole raised slightly. An examination was made on September 27, 1923, when no lateral deviation of the foot was present. The foot was well displaced backward. The child walked with barely a limp and could walk on his toes with his heel off the ground. His mother states that "he does not walk crippled like he used to; the leg has filled out."

THE PARALYTIC DEFORMITIES OF THE FOOT AND ANKLE AND THEIR TREATMENT.

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I was glad of the suggestion that I should present a paper before this Congress on the subject of the paralytic deformities of the foot and ankle, because I feel that the paralytic deformities of this region are the ones about which there is the greatest scope for discussion and about which there has hitherto been the greatest legitimate difference of opinion. The greater our experience in operating in these cases, the greater is our realization of their complexity and of the number of the factors which demand consideration in planning our operative procedure. Further experience over an extended period has shown that many operative procedures which promised well and which indeed give eminently satisfactory results for a time, may subsequently prove to be far from successful owing to the further development of deformity as late as two or three years after the primary operation.

Before entering on a consideration of the treatment of the different types of deformity, it will help to consider the factors which produce deformity. The two chief are gravity and the disturbance of muscle balance. The term disturbance of muscle balance is, I think, the one that conveys the best mental picture of the factors at work. It is all embracing; it includes the effects of the unopposed action of unparalysed muscles and their consequent structural shortening, the effect of the absence of active contractions in the paralysed muscles and also the effect of the loss of their function of active reciprocal relaxation, when their opponents contract; the altered conditions of postural tone and postural length as they affect both paralysed and unparalysed groups; all these conditions come under the heading of disturbance of muscle balance.

Thus we realize how enormously complicated and how finely adjusted muscle balance is in the normal individual. Therein lies our difficulty when we attempt to rectify deformity by tendon transplantation. Do we fully realize how finely adjusted the normal muscle balance is in this region? Considering the region as a whole the combined resultant of ankle and tarsal joint movement gives us universal joint movement in every direction. Not a single one of the muscles in this region (I exclude possibly some of the small muscles of the foot) has the effect of moving but a single joint. Consider the *tibialis anterior* when we are deciding to remove its insertion elsewhere or equally to transplant some muscle to take its place. We are concerned with its action on the movements of the ankle joint, the subastragaloid joint, the mid-tarsal and the scapho-cuneiform joint. Further how slight is the disturbance of muscle balance that is necessary to produce deformity. One meets with many cases of post-paralytic *equinus* in which there appears to be really good power in all muscles; one decides the deformity is postural, that there has been inadequate protection and splinting and that the calf muscles have merely recovered more quickly and more completely than the anterior group. All one considers necessary is lengthen-

ing of the *tendo Achillis* and subsequent protection of the anterior group till they have had time to recover from their prolonged overstretching and to regain a normal postural length. One does this and carries out presumably adequate protection and the use of apparatus, but two, three years later the anterior group is still relatively weak and either the *equinus* will relapse or a further operation will become necessary. The fine adjustment of muscle balance that is necessary renders our problem a heart-breaking one. Is it reasonable to expect that in more than the minutest percentage of cases muscle balance will ever be completely restored by Nature? Where one group of muscles has been affected, is it likely that their recovery will be absolutely perfect; or where one group has been affected and their antagonists also affected but less seriously, is it likely that the recovery of the two groups will be absolutely equal. Unless this unlikely event occurs, there will persist for ever a disturbance of muscle balance, the genesis of deformity. If therefore the problem is so difficult in these slighter cases in which it seems at first sight that we are dealing merely with muscles that have recovered, but have been over-stretched, what are we to say about the difficulties of dealing with cases in which we are left with definite residual paralysis of one or more muscles? If we are going to transplant tendons, let us ask ourselves what we are trying to do. We are making an attempt to restore accurate muscle balance and no rough readjustment will suffice. For example, suppose we are dealing with a *varus* deformity due to a complete residual paralysis of the *peroneus brevis*, is it a solution of the problem to say we will transplant the *tibialis anterior* to the outer side of the foot; but where shall we put it? If we do not place it far enough laterally, we shall still get a *varus* deformity. If on the other hand we put it too far out, we shall be faced with the development of a *valgus* deformity. If every case of paralytic *varus* was due to complete paralysis of the *peroneus brevis* and the *tibialis anterior* was always normal and constant in strength, we might by long experience find the exact spot it is desirable to transplant it to. But often in *varus* there remains some power in both the peronei, often too the *tibialis anterior* has also been somewhat affected though on cursory examination it may appear to possess good power. Thus what may be the right site for implantation of the tendon in one case of *varus*, may be entirely wrong for another. We have no means of working out with mathematical accuracy the power of either normal or parietic muscles or the alteration in their power when they are transferred to a new insertion. In the absence of this knowledge we cannot be sure that our operation will restore muscle balance. Too often the effect of an operation of tendon transplantation is merely to alter the disturbance of muscle balance, not to rectify it. Either the upset of muscle balance is made less evident and to that extent the patient is improved at any rate for a time, or else one type of disturbance is exchanged for another, the deformity cured to be subsequently replaced by a second. The final result, the success or failure of tendon transplantation, cannot be determined till at least two years have elapsed from the time of operation. Remember the initial paralytic deformity as a rule takes some considerable time to develop after the onset of the paralysis. The first step in any operative procedure is

always to correct the fixed deformity and if we did no more, it would be some little time before the old deformity again became fixed. Next suppose we transplant tendons so that we are still left with a disturbance of muscle balance and also subsequently protect the part for some time against the recurrence of deformity by appropriate boots and irons. Then we are putting the patient into the position of one with recent infantile paralysis who is having appropriate postural and splinting treatment, and we are preventing the occurrence of deformity. The mistake we make is that at the end of six months or so we consider that we have protected the transplanted tendon for a sufficiently long period and that the liability to the recurrence of deformity has passed; the patient is discharged and reckoned as a cure. But if there remains disturbance of muscle balance, either the old disturbance or a new type, the liability to deformity is never passed and this is the reason of the very late recurrences of deformity that may occur years after operation. It must not be thought from this that I am opposed to the operation of tendon transplantation. I think tendon transplantation has a very definite sphere, but seldom can it play its part unsupported by other methods; in other words we must make allowance for the margin of error in our estimation of the extent to which our operation on the tendons will modify muscle balance. We make this allowance by invoking the assistance of stabilizing operations. Thus, in a *talipes valgus* in addition to transplanting the *proprius hallucis exterior* to the inner side of the tarsus, we shall ankylose the astragalo-scapoid joint.

Let me now consider one of the individual paralytic deformities of the foot and ankle and its appropriate treatment. My own experience is that from the surgeon's point of view the most satisfactory type of foot to deal with is the foot that is completely or almost completely flail with practically complete paralysis below the level of the knee-joint, with perhaps just a flicker of power in the *flexor longus hallucis* and the *flexor longus digitorum*. The obvious reason is that in this case we are content with less; we can have no hope of restoring voluntary control over the movements; we rest content with providing a stable foot without deformity, one that will furnish an adequate weight bearing support. As has been frequently pointed out these patients with very extensive paralysis often have very little fixed deformity. The absence of all muscle power eliminates the factor of disturbed muscle balance as a deformity producer. Gravity, however, and what little flicker of power does remain will have resulted in some fixation of deformity and they are usually found in the position of *equinus* and slight *varus*. Consideration of these cases, therefore, resolves itself into the question as to what is the best stabilizing operation. We have a choice of several. Astragalectomy and backward displacement of the foot (Whitman); Davis's horizontal transverse section; the triple arthrodesis of Ryerson; Davis's subastragalar arthrodesis. For the flail foot with only a flicker of power at the most in the calf muscles Whitman's astragalectomy and backward displacement of the foot is undoubtedly the operation of choice. The commission of the American Orthopædic Association on stabilizing operations on the foot reported in 1921 to this effect and my own experience bears out this

view. The functional results are excellent; they do not relapse into a deformed attitude; they need no apparatus. The whole crux of the operation is to secure sufficient backward displacement of the foot and to obtain this the structures on the posterior aspect of the tibia and the fibula must be extensively freed from the bone. The plaster must be applied on the operating table with great care to retain the desired position. Even so, there is a possibility that the bones may slip within their ensheathing plaster, so that personally I always make a practice of removing the plaster at the end of two weeks, inspecting the position and applying a fresh plaster. If the correct position has been in any way lost, it can always then be restored under an anæsthetic without opening up the wound. For flail feet I have abandoned all other operations in favour of this one. To my mind the sole disadvantage of Whitman's operation is that it does not cope with the dropping of the fore part of the foot. Where this is not great, I prefer to leave it alone and to retain the natural elasticity of the joints. When, however, it is a prominent feature, Whitman's operation should be supplemented by a wedge excision of bone to correct this fore foot drop. Davis's horizontal transverse section of the foot has also been largely performed for flail feet. It is a much more difficult operation than Whitman's; it may be tremendously difficult to secure sufficient posterior displacement of the foot. I have found it difficult to see what I am doing in carrying out this operation and the exposure of the parts is relatively inefficient. It possesses the very real disadvantage that in cases of considerable lateral instability of the ankle joint, a not uncommon occurrence in these cases, this condition is left unattacked by it. The subastragalar arthrodesis of Davis and the triple arthrodesis of Ryerson are not operations indicated for flail feet though they are sometimes performed therefor. Any operation for flail feet must consider the problem of the incidence of body weight down through the leg bones on to the foot, that is the statics of the ankle joint must be considered. The two operations that have the greatest success, namely Whitman's and Davis's, both have this in common, they both displace the foot backwards on the leg, so that the weight falls more directly over the middle of the foot. They differ in that Whitman's by removing the astragalus and allowing the malleoli to fit down and seize the tarsal bones in their grip overcomes the problem of the lateral instability.

DR. N. D. ROYLE spoke with reference to treatment in the pre-operative stage. The limb should be rested in a position which imitated the ordinary posture in the erect attitude. At the same time gravity should be prevented from exaggerating this posture. Over-treatment should be avoided in that active movement should not be carried to the point of fatigue.

DR. W. KENT HUGHES expressed himself as greatly disappointed with the trend of the papers. Sufficient emphasis had not been attached to complete rest in the early stages. In the neglect of this principle was to be found the explanation of many deformities. Rest, by which he meant rest to all the muscles round a joint, was secured by retention of the joint in the mid-position. Once contractures had occurred, they must be corrected by resolute division of all the soft structures preventing restoration. There was no limit to the time during which recovery might be expected.

Section X.—Naval and Military Medicine and Surgery.

ORGANIZATION OF THE AUSTRALIAN MEDICAL PROFESSION IN TIME OF WAR.

By COLONEL G. W. BARBER, C.B., C.M.G., D.S.O., V.D.
Deputy Director of Army Medical Services for Western Australia.

I MUST congratulate the President on his choice of subject.

It is somewhat startling to think that six years after the termination of the late war such a paper is necessary, but further consideration shows that such is the case for, although the Australian Army Medical Corps developed into a corps equal to any in the field, it must be remembered that it was not entirely complete; Australia did not furnish such units as motor ambulance convoys, ambulance trains, base and advanced depôts of medical stores, Army water columns or field hygienic and pathological laboratories; also that the Australian Army Medical Corps of the present day is not nearly as efficient as it was immediately prior to the late war in 1914.

The organization was incomplete then and is still incomplete even on paper. This loss of efficiency is due to enforced economy resulting in diminished establishments and length of training and particularly due to the impossibility of training officers efficiently, owing to the post war alterations in the establishments and equipment of field ambulances, with the result that the "Royal Army Medical Corps Training Manual," addenda to the "Royal Army Medical Corps Training Manual" (1921) for mounted ambulances, "Field Service Manual" and "Manual of Ceremonial" have become more or less obsolete and nothing has yet been issued to take their place and, of course, no officer in Australia has any experience in handling field ambulances so organized in time of war. To take an instance, such as packing and loading of wagons, which is one of the subjects for the examination and promotion of officers, the new establishment shows a reduction of two general service wagons, but the "Field Service Manual" has not been amended to show how the remainder of the wagons should be packed. It is, of course, desirable that the Australian organization should be similar to the British even if some of us do not see the necessity for certain changes in the organization, but until the necessary amendments are made in the various training manuals or until we revert to the organization which proved so effective in the late war, it will be impossible to train efficiently. I regard this as highly important as the medical officers of the Australian Army Medical Corps, Citizen Force Active List and those who had seen previous active service were the backbone of the Australian Army Medical Corps, Australian Imperial Force. The training before the war was of the greatest possible value, but now it is desirable that medical officers should be still more highly trained as they will be unable to rely on warrant and non-commissioned officers owing to diminished peace establishments and training.

The organization of the Australian medical profession in time of war will vary with the nature of warfare, which may be: (i.) Overseas (Expeditionary Force) or (ii.) defence in the event of an attack on Australia.

As regards the first no particular organization of the profession is needed, as I have no doubt there would be plenty of volunteer untrained medical officers available, but I anticipate that there would be considerable difficulty in securing the services of competent officers for command and administration, owing to lack of training in the past five years, and that many of those who are competent and have proved themselves so on active service, would find it impossible to volunteer, however much they wished to, owing to the obligations they have contracted since their return, the difficulty of re-establishing themselves and liabilities contracted thereby. These officers did not obtain the same repatriation privileges as other officers and the pay was not equal to that of other medical corps serving with the British forces. A second experience would probably involve some of them in total ruin.

The necessary personnel for medical examinations for fitness for service and for home service to deal with returned sick and wounded could be provided by mobilization of officers from the active, unattached list and members of the Reserve.

As regards the second form of warfare, defence in the event of attack on Australia, medical officers would be required for Navy, Army, air and civilian services. Many would be required: a few consultants, surgical and medical, say two on the staff of the Director-General of Army Medical Services, Directors of the Naval and Air Force Services and Director of Medical Services of the Army in the field respectively; a limited number of specialists, surgical, medical, aural, ophthalmic, pathological and radiological, for service with casualty clearing stations, stationary and base hospitals, also sanitary and dental officers for the field and base. The remainder would be available for field, lines of communication or base according to their knowledge and capacity. Some would have to be held in reserve to replace casualties and shortages in one military district met by transfer from another.

The most useful man in the field is the young and healthy general practitioner of a few years professional experience, who has trained with the Australian Army Medical Corps in peace and is capable of making a fairly correct diagnosis without the aid of X-rays or a pathological laboratory *et cetera*.

Naval and Air Force medical officers should be men capable of adjusting themselves to their special environments.

Administrative and commanding officers are the most difficult to find as all who have had to recommend officers for these posts well know. A commanding officer should have a better knowledge of the various activities of his command than those whom he commands, be a capable organizer and have the faculty of enforcing cheerful obedience. Administrators in addition to the qualities desirable in a commander should possess the faculty of imagination which will enable them to foresee and provide for the difficulties and troubles which are sure to arise on active service.

The number of Australian Army Medical Corps officers required for a division in the field with artillery, cavalry and the necessary lines of communication and base units would be roughly three hundred, but this includes area medical officers, Army Service Corps officers, dental officers, quartermasters and *padr s* attached.

It must be remembered that it would be necessary to provide for the medical units of six lines of communication and bases, a complete organization for each military district and also possibly lines of communication and base for a force operating in Northern Australia. The Navy would require hospital ships and their casualties could be transferred to military hospitals at the various bases. The Air Force would transfer casualties to the nearest medical unit as they did in the late war.

The combination of the Naval, Military and Air Medical Services under one administration and a similar combination of the various Commonwealth civilian medical services would facilitate medical arrangements and the provision of medical supplies and equipment and undoubtedly result in great economy.

In addition medical officers would be required for State service and the needs of the civilian population.

I am of the opinion that it would be necessary to render the whole medical profession liable to mobilization. Members should be called up for service as necessary by a man-power board in each military district. A satisfactory constitution of that portion of the board dealing with the medical profession would be three medical members nominated by the Army Commander, State Government and British Medical Association respectively. Officers on the active and unattached lists would be mobilized first and should have preference for command and administration and rank for which they have passed by examination, then officers on the Reserve with rank held on Reserve, if vacancies exist, then medical officers on the retired list, if fit for active service, then volunteer civilian medical practitioners and lastly civilian medical practitioners who have not volunteered. The latter should be called up with rank and pay of captain with separation allowance for service as required and with due regard to requirements of the civil population.

I am opposed to the granting of higher rank except for the purposes of command and administration, but am in favour of specialist pay as obtains in the Royal Army Medical Corps.

At a staff tour held last year in the Fifth Military District the question of the care, accommodation and segregation of civilian patients arose, also the sanitation of concentration camps for the homeless and the removal of lunatics and inmates of charitable institutions away from the theatre of operations. It was not clear as to whether the responsibility would rest with the State or Commonwealth Government, but I have no doubt that it would be necessary for the Army Commander to assume this responsibility within the war zone, using the State machinery for this purpose. This would be all the more necessary as the Army would take over supplies. These duties might be undertaken by officers detailed from the Australian Army Medical Corps, and this would probably be the most satisfactory and economical method.

As an alternative I suggest that the chief State ad-

ministrative medical officer should be given equivalent rank and pay to that of an Assistant Director of Medical Services and be responsible to the Army Commander for the care and accommodation of destitute civilian patients and for coordinating civilian sanitation with the military organization and that adequate civilian personnel paid and graded at military rates be allotted to him. This personnel could be drawn from those engaged in the care of the sick, and prevention of disease, in civil life, less those called up for service with the forces. Supplies and transport for civilians to be arranged for by the above officer with the military headquarters.

It is presumed that the State and Commonwealth Governments would still function outside the war zone and that civilian medical officers, whole or part time, would be required for State or Commonwealth Service outside the war zone and for the necessities of the civilian population engaged in production, therefore it should be one of the functions of the man-power board to allot sufficient medical practitioners for this purpose.

The stringency of medical examination for fitness of medical officers for active service might well be relaxed, as I know of excellent men who were eager to serve in the late war, but were rejected on account of disabilities which were no real bar to a service at the base or on the lines of communication.

If measures are taken during peace to train adequately the present number of medical officers on the active list, to increase slightly the number of warrant and non-commissioned officers of the Australian Army Medical Corps permanent services, to provide medical, surgical, dental and ordnance supplies necessary for medical units in time of war, to publish complete war establishments and equipment tables for all medical units required and to include a scheme for dealing with civilians in mobilization orders, I think that the organization I have outlined could be carried out effectively and should be acceptable to the medical profession.

The above measures would involve a slight additional expenditure, which in my opinion, would be justifiable, for the Army Medical Corps commences to function in all its branches from the moment mobilisation commences. If matters are allowed to remain as they are, our next mobilization will see similar avoidable waste in manpower and expenditure to that which occurred in the late war.

The British Medical Association could render much assistance to the services in connexion with mobilization plans and it would be well if the Association formulated a definite policy which should include measures to protect medical officers' interests and to encourage the members of the profession to train during peace in order that they may successfully apply their professional knowledge during war.

SURGEON-CAPTAIN E. W. P. EAMES related a war experience at Grimsby to which town he took a man with a depressed fracture and found that owing to enlistment of medical men, only one surgeon was in attendance and Surgeon-Captain Eames had to operate on the patient as the one surgeon was exhausted. The profession should be organized for war. They should have a good reserve of

partially trained medical men before a war, because those trained officers in command when a war commenced, had not the time to train raw volunteers.

COLONEL D. M. McWHAE, C.M.G., pointed out that the chief necessity at the present time was for adequate equipment. Large numbers of trained medical personnel were available but, as time went on, these numbers would decrease and the importance of efficient training was therefore great. He did not see why they should restrict compulsory mobilization of medical men to the event only of an attack on Australia for, probably, it would be acceptable to the medical services and to the British Medical Association if all medical men were made liable to mobilization in the event of a great war overseas similar to the last one. Information was required in connexion with all medical practitioners under the following headings: (i.) Medical classification, fitness for general service, fitness for duty at the base and on lines of communication, fitness for service in Australia; (ii.) war experience and training of officers on the Reserve and on the retired list and surgical and medical experience of civilian practitioners.

Further, information was necessary as to the minimum number of medical men required for civilian duty and the number that would be required for military service with certain necessary units for which there was not any stated establishment, such as the Army Corps, lines of communication, command depôts, Australian Army Medical Corps training depôts, hospital ships, ambulance carriers and reserves.

As a result of practical experience many officers had worked out standing orders for their various commands in the recent war and these standing orders should be at hand and kept available.

The most essential point to be noted was that, if liability to service belonged to all, the service in the Expeditionary Force, the service in Australia and the men engaged in civilian practice would work as a harmonious whole and there would be one administration and one policy for the force overseas and that in Australia, thus preventing the lack of cooperation which was the worst feature of the work of the medical services in the last war.

COLONEL S. R. BURSTON, C.B.E., D.S.O., said that though it was understood that there was a new organization and new equipment tables had been prepared, the details were not available and that the "Royal Army Medical Corps Training Manual" of 1911 was still in use. He commented on the want of economy involved in the sending of unfit men abroad only to have to return them and pointed out the need for great care if anything was to be done in the direction of lowering of the physical standard of recruits. He had often found during the war that C class men were quite unsatisfactory.

Some experience was necessary for the satisfactory medical examination of recruits and he was of opinion that the grading into A, B and C categories which was operative towards the end of the war, was the best system. The provision of medical stores for a war in Australia would be a difficult matter because many of them had to be imported at present. He supposed that dressings and instruments could be commandeered for the services, but in that case the civilians would suffer as a result of the shortage of these articles. He regarded it as important that there should be complete coordination of civil and military medical services.

COLONEL LANGFORD LLOYD, C.M.G., D.S.O., said that there were two main questions to be dealt with in the

present discussion. The first was the organization for possible combination with British forces abroad, as in the late war. In this case a definite period would be allowed to elapse for the Australian fraction to get organized and trained before joining up with the other British forces. It was essential that such an organization should be kept definitely in line with that of the other British forces and it would be unnecessary to provide such units as motor ambulance convoys and base or advanced dépôts of medical stores or pathological laboratories and probably an Australian stationary hospital would not be needed, though a general hospital should be included in the organization scheme. The second point was that a far bigger organization would be required if Australia were invaded. Points around the coast that were likely to be used as landing places for an enemy, should be specially studied and the probable strengths of the landing forces should be carefully considered. The closest correlation of civilian and military medical services was of great importance and detailed defence schemes should be arranged and by means of staff rides and other field operations should be thoroughly tested. He had observed while in Australia that there was not sufficient training in progress to enable officers to be sure of themselves if a sudden emergency were to arise. It would appear that equipment was scanty, he supposed for want of funds and he thought they should have equipment for each variety of medical unit in arsenals or earmarked for use in emergency, such as cars for motor ambulance convoys and equipment that could not be readily obtained.

Training should be so arranged that units could be assembled quickly from nuclei. The Territorial Forces in England had been considerably reduced in strength and about the end of 1920 or early in 1921 they were recruiting only the equivalent of one field ambulance for the medical service of each division.

It should be remembered that field work was more technical than hospital work and special attention should be paid in training, but even general hospitals and casualty clearing stations required a basis of military training. The territorial scheme of England might with advantage be attached on to the defence scheme of Australia. On a war basis the Territorial Forces contained twenty-three general hospitals, but at present only one of them was being maintained for training purposes with a personnel of commanding officer, registrar, quartermaster and thirty-seven other ranks. In the same way a skeleton casualty clearing station was maintained.

COLONEL A. GRAHAM BUTLER, D.S.O., considered that two organizations were required, a military one and a civilian one. The demands of the military medical service must be made known to civilian medical men. Though there were no post-war training manuals or revised establishments, it was certain that the organization would be precisely the same as the British one. The phase of the subject that attracted the speaker in connexion with the preventive policy of Congress was the prevention of mistakes in military medical organization. The compulsory military training scheme in existence exempted medical students, but after qualification a medical man was commissioned as a lieutenant in the Australian Army Medical Corps and underwent some training until he was twenty-six, when he became a captain and went on the Reserve, if he did not voluntarily continue in the militia. It was regrettable that he did not always receive an effective medical corps training. During the war out of twelve to thirteen hundred medical men who received commissions and went abroad, more than three hundred had their appointments terminated before the end of the war, so that

a great reserve of medical men was required in war time. One medical officer had been required in the Australian Forces for each three hundred soldiers who went abroad and this calculation did not allow for those medical men required for the care of those men who were invalidated out of the service or for those in semi-military employment in Australia.

Tacitly it had come about that military medical men fell into two categories, those available for service anywhere in any capacity and those who were only available for technical service and were not fitted for other duties. For example if promoted to a command, they could not fill such a position satisfactorily and some provision to meet the difficulties regarding promotion and so on was a great desideratum.

Medical stores held at the outset of the war had proved sufficient only for the first division and thereafter England had at a cost arranged supplied the necessary stores for the force abroad. They were not yet self-contained and could not supply all drugs and dressings for an army. When in 1916 the adult population of military age was to have been called up, the Director-General of Medical Services drew up a scheme for the organization of the profession and this was available as a help to future action.

COLONEL J. A. DICK, C.M.G., urged that the organization of the medical profession in time of war was a matter that concerned all of the members of the medical profession. The extent of the war would determine the numbers required and undoubtedly in the case of a large war, such as an invasion of Australia, the whole profession should be, for want of a better word, conscripted under the present Act or a *National Service Act*.

The delicate question of deciding what medical men should be called up ought to be left to a board such as that suggested in his paper by Colonel Barber or settled on similar lines. One of the objects of this board would be to keep the civil population efficiently supplied with medical men as well as to supply sufficient medical officers for the Navy, Army and Air Forces. The notice of those present was directed to the publication entitled: "The Mustering of Medical Service in Scotland," written by J. R. Currie and published in 1922 by Morrison and Gibb, Limited, at Edinburgh at the price of three shillings and sixpence.

COLONEL R. M. DOWNES, C.M.G., agreed with Colonel Barber that they had been better organized in 1914 and said that it was a question of the taxpayer. He informed the meeting that medical mobilization plans were drawn up and kept ready and that he had perused an advance copy of the new equipment tables a supply of which was likely to come to hand soon. The service had been considerably handicapped by the separate organization at home and abroad during the war and he supported what had been said about the desirability of unification.

COLONEL W. E. SUMMONS, C.M.G., remarked that it was true that they could not provide stores in sufficient quantity for an army in the field and that the shortage of equipment was greatly to be deprecated. He was strongly of opinion that there should be a liability of the whole of the profession for service in time of war and proposed that:

This meeting recommends to the Federal Committee that all members of the medical profession be liable for service in time of war.

This was seconded by Colonel T. Morgan Martin and when put to the meeting, was carried unanimously.

(To be continued.)